Educational Technology in Support of

Joint Professional Military Education in 2010: The EdTech Report

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Abstract

At the request of the Director of the Joint Staff, a study was made of the potential for the Joint Professional Military Education to meet the emerging needs of Joint Vision 2010. As part of the study, an effort was made to benchmark current policy and practice and identify trends in educational technology in academia, industry and government. This is the report of the "EdTech Team". Distributed learning is defined as the delivery of instruction to remote learners supported by innovative computer-based tools. Since 1993, the number of institutions reportedly active in distributed learning in the U.S has risen from 40 to more than 700.

The report is organized into a series of seven thematic chapters. Each is authored by a team member and is based on the data collected. Thematic chapters include: defining requirements, keeping the learner central in the process, learning domains, technology tools available, evaluating programs, faculty considerations, and future trends.

The primary finding of the inquiry is that technology will provide the JPME system means to support the emerging requirements of JV 2010. The limiting factors will be resources. The value of the report is that it documents broad evidence of innovation and provides points of reference.

Acknowledgment

This inquiry could not have been successful without the efforts of a great many people. Contributors to this study earned our deep appreciation for giving us their time and answering detailed, sometimes pointed questions about their programs. Ms. Ida Jones of the J-7 MED provided countless travel orders. Ms. Angela Shanks of the National Defense University Telecommunications Department provided a steady hand to calm an occasionally shaky LAN or balky ISDN terminal. Of their extra efforts came this report.

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Executive Summary

At the request of the Director of the Joint Staff, a study was made of the potential for the Joint Professional Military Education to meet the emerging needs of Joint Vision 2010. As part of the study, an effort was made to benchmark current policy and practice and identify trends in educational technology in academia, industry and government. This is the report of the "EdTech Team". It addresses an emerging "anytime / anywhere" education and training model that is growing very rapidly in corporate and academic America.

Most of those interviewed agree that distributed learning, the delivery of instruction to remote learners, both individuals and groups, anytime, anywhere, supported by innovative computer-based tools, is the leading edge of educational technology. In 1993, there were 40 institutions reportedly active in distributed learning in the U.S. In 1997, the number was 700 and increasing rapidly. Recently, *Barron's* and several other trade magazines carried news of Michael Milken's new venture, Knowledge Universe Inc., a $1B conglomerate of private educators, trainers and courseware authors. Milken is targeting an education and training market he says is worth $600B, and partner Larry Ellison, former Microsoft founder, agrees.

Included in the Joint Staff EdTech inquiry are a television network at Stanford University that has been turning out electrical engineers since 1969. There is a new virtual university founded by the Governors of four Western States and a web-based teacher training facility at MIT. There is also an interactive automobile repair system from General Motors that accelerates learning for auto mechanics. There is also a scenario visualization system at Sarnoff Labs that harnesses three dimensions. But the inquiry only scratches the surface of Milken's market.

The inquiry was driven by a compressed time schedule. Lacking an agreed roadmap into representative samples of the total educational technology population, it used a 'networking' approach. That is, the Team contacted such experts as the group could name, and asked them for additional names. For these reasons, this report provides only anecdotal evidence of the breadth and depth of educational technology today. The report is organized into a series of seven chapters, each on an important theme. Each chapter is authored by a team member and is based on the data collected.

Chapter themes include: defining requirements, keeping the learner central in the process, learning domains, technology tools available, evaluating programs, faculty considerations, and future trends. Real innovation was found in each of these areas. Issues in some are ongoing and are addressed as unresolved. Almost all contributors shared concerns for quality, organizational culture, and critical thinking that are important to the JPME system.

The primary findings of the inquiry are that post-secondary education is developing an "any time/anyplace" model driven largely by the needs of business. The emerging model is "learner centric" in that it brings sophisticated tools to bear on the learning process to insure quality as education moves from the traditional classroom to distributed learning when and where convenient to the learner. The bottom line is that technology will provide the JPME system means to support the emerging requirements of JV 2010. The limiting factors will be resources. Technology offers the means to personalize and forward much education and training beyond the traditional classroom. But practitioners are divided on the long term results, largely because distributed learning via computer-based methods, the majority of new starts, is so new.

The value of the report is that it documents broad evidence of innovation and provides points of contact for further inquiry. An extensive bibliography is included.

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Introduction: Benchmarking Pandora's Box

"Instruments are at hand which, if properly developed, will give man access to and command over the inherited knowledge of the ages."
Vannevar Bush, 1945

"[E]merging technologies may reshape both face-to-face and distance education...[using] knowledge webs, virtual communities, and shared synthetic environments." Chris Dede, Ph.D., 1996

Early this year, the Chairman of the Joint Chiefs of Staff asked for a review of Joint Professional Military Education (JPME) in terms of insuring that the system will adequately support the needs of U.S. forces in the year 2010. A team composed of educators from each of the Services was established to benchmark current leading edge educational technology policies and practices in academia, business and government outside of the Department of Defense. Besides benchmarking current practice, the "EdTech" Team was asked to identify potential trends. Over a period of 45 days, the Team interviewed numerous practitioners in various places in the U.S. using telephone conferences, the Internet, and direct contact. This report presents the Team's findings. An unintended consequence of this inquiry is that it opened "Pandora's Box". While the Team probed for the leading edge of educational technology, leading edge practitioners found out the size and the status of the "professional military education business opportunity".

What the team found could, in general terms, be likened to the stories of the Oklahoma land-rush at the close of the last century. The global introduction of the Internet in 1993 spawned a "shotgun start" on a wide front to secure a place in a new territory before the opportunity was gone. The rush to harness a broad menu of proven and promising technologies is today closing the book on the limitations of traditional classroom education and training as surely as the final land rushes of a bygone era closed a frontier. This report will have value if readers use it to reach out to the innovators and partner in ways to perfect invention and regularize discovery. For those who are looking for a comprehensive catalogue of conveniently documented templates for easy application, the Team found that such a catalogue, if even possible with a lot more time, would be obsolete before printing. Education technology is moving too fast for handbooks.

In 1993, there were reportedly 40 institutions offering distributed learning via electronic means, largely synchronous television. Stanford University's Stanford Instructional Television Network (SITN), which began in 1969, is an outstanding example. As a former Program Manager at GTE in 1973, this author approved several requests from engineers to finish Bachelor of Science in Electrical Engineering (BSEE) or MSEE programs via SITN. The program has reportedly graduated thousands of engineers in its distinguished tenure. By 1996, there were over 700 such programs, many now using the web, as opposed to cable TV. There was not time to benchmark, or even conduct a rigorous sample of all of these programs for this study effort. What was possible in 45 days was to reach out to a number of proven programs, those with successful graduates, in order to document policies, procedures and issues relevant to JPME. Those fact-based impressions are the basis and the value of this report.

The Team found great breadth and depth to the innovation on-going in educational technology relevant to JPME. There is a fundamental shift in education philosophy for the adult learner from concentrated periods of learning, such as multi-year degree programs, to a continuous "lifetime" learning model, continuously pursued, any time, and any place. Under the new model, degree programs are still important, but more important is that the learner stay engaged in learning throughout a lifetime. Formal degree programs are being stretched out as learners compete with business and life needs to find time to complete courses. Learners are demanding courses "anytime/anywhere" and institutions are responding to stay competitive.

By way of continuing with the example just raised, today's SITN at Stanford has an Internet option. Not only are classes carried asynchronously, that is without the teacher present anywhere, but library resources are offered to facilitate research from the terminal. Databases are established to aid students in answering questions. Enrollments, course selection, book buying, testing and grade reporting are available at the web-site.

At George Washington University Dr. Badrul Khan assembles web-based research aids to assist students in learning how to efficiently use the web to do research. Dr. Chris Dede reports that Vanderbilt University students use "Jasper" to learn reasoning, problem solving, and complex math in the context of scenario-based adventure called "Rescue at Boone's Meadow." At MIT, Dr. Georgiana Davenport conveys multi-disciplinary topics in a computer-based matrix of the life of a giant in American science and education, Jerome Weisner. These and many more examples await the reader in the chapters that follow.

The format of this report is a collection of chapters which focus attention on major themes found in observations of over 30 programs. The observations were the result of interviews made in person, by telephone and via email with people actually managing distributed learning programs in academia, industry and government. Interviews were built based on a set of assumptions the Team compiled in the first days of its existence. It is a significant finding of this research that the assumptions have been validated by those the Team interviewed. It may be useful to review them here.

STUDY ASSUMPTIONS

In order to more efficiently approach the tasks of benchmarking current distributed learning initiatives and assess future trends, certain assumptions must be made. The EdTech Team assumptions used are:

a. *Technology will support JPME 2010 requirements.*

   The technology necessary to support developed programs will be available as evidenced by the advancements and trends in error checking, compression, coding, transmitting, physical plant, and topology technologies. Whether analog or digital, copper, fiber-optic, radio frequency, infrared, or microwave, the capabilities of distributed learning technologies will continue to increase.

b. *Cost of distributed learning technologies will decline.*

   Cost will continue to decrease. The decrease in cost will afford government and civilian organizations the ability to continue the upgrade of current systems. This assumption reflects a well-established market trend line. It has been universally true that, with each improvement in information technology, the greatest cost is born by the earliest adapters and the costs rapidly decrease as newer technology comes on line. A contributing well-established trend is that information transport costs are dropping as new technologies allow greater use of current transport systems. The increase in fiber capability and capacity is a relevant example.

c. *Object-oriented standards will evolve.*

   Any form of distributed learning developed to satisfy JPME 2010 requirements must be used by individuals from any Service, organization, location, etc. Currently, there are collaborative efforts between DoD, industry, and academia at the forefront of development of object-oriented standards for various aspects of Interactive Multimedia Instruction. These efforts are well supported by all participants and are planned to result in the development and acceptance of universal object-oriented standards and the true interoperability of courseware and course management systems in the near future.

d. *Open (platform independent) architectures will be a reality.*

   The software design process will make use of the output from other software (imports), furnish inputs that can be used by other software (exports), run other software (as a host), and/or facilitate communication with other computers, independent of the computer type. Educational programs will continue to migrate to and achieve a platform-independent standard.

e. *Focus is on learning – not education & training.*

   Effective learning is the focus, regardless of the motivation--education or training. We define education as a methodology whereby individuals learn about a topic in such a way that they are able to think differently about the topic, postulate hypotheses about the topic, and continue to learn about the topic and related topics on their own. We define training as a methodology whereby individuals learn a well-structured, repeatable process in order to achieve a desired goal. In both cases, learning takes place--only the motivation is different.

f. *OPTEMPO/Readiness will require job-related learning to become part of a normal duty day.*

   In order for JPME 2010 to achieve its utmost success, distributed learning cannot be viewed as an "other duties as assigned" activity. It is not enough to make distributed learning material available, it must be given the same priority as that established for readiness. Distributed learning must be provided command emphasis and support as an active, on-going requirement. It must be integrated into the tempo of operations (OPTEMPO).

g. Learning will be available at the unit level.

Accessibility is critical to realize the benefits of distributed learning. The rapidly changing tasks of the military will require new curriculum distribution strategies to allow quality learning to be made available to the Warfighter. The Warfighter must be able to access learning materials "wherever and whenever".

h. JPME 2010 applies to the Total Force (Active, Reserve, and civilian components).

The Goldwater-Nichols Act does and will continue to require JPME for the Total Force as an integral part of the DoD strategy for supporting one or more Major Regional Contingency (MRC) and as the foundation of all CINC plans to expand to general war.

METHODOLOGY

From the study assumptions, a list of interview questions was devised for the purpose of insuring uniformity in data gathering. While not every question was wholly relevant to every interview, the Team was able to use the questionnaire as a point of departure for exploring cogent themes. Notes from the interviews were the basis of the chapters in this report.

The sample size of distributed learning programs was very small in proportion to the number of programs in being, largely due to the compressed timeframe of this study and funds available for research. The sample size was not judged to be representative of the total population of distributed learning programs because it was developed "on the fly" using casual referrals. For both of these reasons, no attempt is made to statistically quantify study results nor to suggest that it is truly representative of all that is on-going in distributed learning. It is, as was suggested, an anecdotal collection of what appears to be a rising tide. The value of the report is that it provides documentation of some things known to work and some places to go for further development.

DISCUSSION

In the chapters that follow, Team members discuss themes which emerged from the benchmarking and trends effort. These themes proceeded from the goals of the study, the assumptions initially made, and directions provided by the data. Despite the lack of hard quantifiable data in many areas, researchers were driven by the tangible success and the confidence expressed by distributed learning operators who were "betting the farm" on their programs.

MAJ Chris Sharp, USMC, an instructor from the Marine Corps University, leads off Chapter One with a discussion of requirements analysis as practiced by program operators. In his chapter, Chris discusses a range of programs from the well planned to the "on-the-fly." It was apparent that time and financial resources could be wasted by taking a "here is the technology solution , now find the problem" approach. The careful reader will take note of the dynamic nature of distributed learning and the value of having a “living plan”.

Of the institutions interviewed, most began their distributed learning program based on a plan, satisfactory to their administrators. Many were experimental, especially in academia. Experimentation is part of the academic charter. In the corporate world, few programs were funded without approval of a successful business case.

It was common to find that the longer running programs, like those which have run for 25 years or more at places like Indiana University, University of Wisconsin, and Stanford University, have built their programs incrementally over the years. Others, like the Western Governor’s University have launched bold new comprehensive programs based on broad studies of what works.

Learner centric focus and planning is addressed in Chapter Two by Tom Hazard, a retired U.S. Navy officer now employed at the Institute for Defense Education Analysis at the Naval Postgraduate School. Tom looks at the challenge of matching the many technology products and procedures available to the needs of the student, the faculty and the JPME system. He gives examples of what works in similar civilian circumstances. He cautions about what does not appear to work well. Between the two extremes, he offers planners ample bounds within which to craft alternative strategies. The reader will note that many of the concerns expressed in DoD, such as cohort building, are shared concerns for which industry and academia are finding solutions. He points to an “opportunity cost of training” that translates well to our concept of readiness.

In Chapter Three, LTC Don Gelosh, USAF, of the National Defense University faculty discusses the technology toolbox available to distributed learning planners. Drawing from a variety of sources found during the Team's research, Don provides JPME planners topics, points of contact, and reasons to explore selected ideas further. His reference to the work of Tom Russell at North Carolina State University is worth noting. Russell’s data base of hundreds of comparative studies done over several decades closes the argument on which is better – classroom or distance learning. There is no significant difference.

Next LTC Fred Vornbrock, USAF, of the Air University explores how distributed learning managers are evaluating their programs. Methods and tools are explored which show great promise for the JPME system. Fred uses his considerable experience at coordinating the Air Force's large synchronous VTC network to look at conventional and some leading-edge ways to evaluate whether learning is taking place. He reinforces the requirement to first develop a plan.

In Chapter Five, Ken Pisel, Chief, Distance Learning Division at the Armed Forces Staff College looks at the learning domains being touched by distributed learning today. Mindful of the crumbling distinctions between *education* and *training*, Ken focuses firmly instead on *learning* and looks at the important education in ethics, traditions and mores, as well as motor skills, that takes place informally in a group and an institution. His conclusions point to the inherent flaw in rapid benchmarking. Without time to dig into an individual program, evaluation must be based on what is explicit and evident. Much could be happening that the Team just did not see.

In Chapter Six, this author looks at faculty issues that are so closely coupled with educational technology that they must be treated with it. Intellectual property rights and time requirements for distributed course management are viewed from the perspective of this former faculty member at the Army War College and current Adjunct Professor at the Joint Military Intelligence College. The article examines a few of the ways technology frees the faculty from some of the burdens that have been roadblocks to establishing distributed learning programs. A significant innovation is that some of academia places high emphasis on the enduring worth of lectures by Nobel Prize winners and other leading practitioners, creating a rich institutional archive for succeeding generations. Contrast this with the view in most PME institutions that prestigious guest speakers are not recorded in order to preserve "non-attribution".

Finally, John Shulson from the U.S. Army Combined Arms Support Command, closes the discussion in Chapter Seven with a look at some trends that can be discerned from the research conducted for this study. John cuts a broad swath because the gains which accrue in distributed learning, especially via the Internet, benefit students, teachers, administrators and managers to significant depths. It is apparent that distributed learning is mainstream in American education and accelerating in growth. John's even treatment of some exciting innovations should convince educators and trainers alike that it is safe to invest in the new technology. More than safe, it is imperative.

If these authors and this report has demonstrated for JPME planners that theirs is not a unique system, nor one challenged by unusual circumstances, but amenable to proven and cutting edge educational technology, then the report has served its purpose.

FINDINGS AND CONCLUSIONS

It is significant that our study assumptions appear valid, at least from this sample. While no one has perfected forecasting the environment in the year 2010, it appears that our assumptions fit well with those developed outside the study via independent means.

More importantly, our initial finding must be that the higher education system is in considerable flux as institutions rush to cope with demands from mobile learners and employers. The education market place today is highly competitive, driven by an “any time / any place” model that makes continuous or ‘lifetime” learning a reality. Technology declines in cost as others like rent, travel and wages increase. Time compresses for all. Pressure from students and employers to deliver education to a time and place convenient to lifestyles was a common demand seen by civilian educators. A few institutions like

Carnegie Mellon University have an institutional mandate to innovate and remain on the leading edge and therefore must be early adapters of the new model.

The second significant study finding is that issues thought to be unique to the JPME system are in fact common to a variety of other educators. Costs must be weighed against benefits. Quality must be maintained. Progress appears to be a way of life among those interviewed because they are all in commercially competitive environments that assign the complacent to anachronistic obsolescence. Innovate to meet demand; or die is the market place reality for them. Concepts such as socialization, mores and traditions of professional service, cohort building, professional network building and competence testing are common to most education programs, especially at the graduate level. Global reach is as important for the 100,000 Domino's students in 65 countries as it is for DoD. Fears of failure to maintain standards by shifting in whole or part to asynchronous, remote instruction appear ill-founded.

The third significant study finding is that Educational Technology can probably support any direction that JPME managers want to go. Technology is often said to be neutral to development. When co-evolved with organization and policy, technology is not seen to be neutral, it is a multiplier of progress. It was reassuring to the Team to find that industry, academia and some places in government have successfully brought together a variety of resources to achieve excellence and efficiency.

It was exciting to see the possibilities for future enhancements to learning being crafted at places like the Sarnoff Labs, Northwestern University, and Universal Studios. More than virtual environments, three dimensional perspectives like that from Sarnoff's "JOVE" display system seem ready made for giving students a macro view of problem solving, competence testing, or incidental learning. Co-evolution of these technologies with organization and policy will multiply their value.

Related to the co-evolution going on in the civilian world, is what may be considered an unintended consequence of this study. An entrepreneurial spirit permeated the people and places the Team interviewed. There was surprise that the JPME system is so late in harnessing the possibilities of distributed learning. It gave a "Pandora's Box" quality to our research.

What is meant by Pandora's Box is that by formally asking for comparisons, DoD has now informally opened its mainline PME process to external comment. The Team is confident from the responses we've gotten that the study has awakened outside of DoD a view that there is profit to be made by exporting their success and experience to so large an education system. Renovating JPME may not much longer be solely an internal option; it may come from concerted external pressure in the form of a mandate. Including the metaphor in the title of this report highlights the significance of this unintended consequence.

Beyond the three primary findings, others merit note. It was significant that all experienced course operators found higher drop-out rates for distributed learners. It takes a special discipline to carry through. DoD has seen this for years in its numerous correspondence programs. Civilian education in America has always been defined by its numerous "second chances" for the casual student to "get serious". It is apparent that some graduate schools are using the superior discipline necessary to complete distributed learning to cull the "apt but unmotivated."

It was also significant for trends analysis that IBM, Arthur Andersen, Lotus and other major software vendors are opening distributed learning business areas. There is a split developing in the computer industry on where the PC is going.[1] IBM sees the future through "thin-client " user terminals for mainstream applications like learning. Main frame computers powering education and training networks will have capabilities that client-server environments at small businesses and campuses cannot match.

Finally, the Team came away from its observations convinced that the JPME system today lags comparable education programs in academia, industry and government for the provision of satisfactory post-secondary education and training. By "satisfactory" is meant that fully accredited education, even at the graduate level, and fully certifiable training, even at the technical level, is being carried out in a wide variety of places and programs. The civilian education and training community has embraced distributed learning in its most modern web-based forms and is successfully using it to a degree not now contemplated in the JPME system. It is apparent that there are efficiencies and savings from distributed learning that have been proven to be possible elsewhere without sacrificing quality.

In 1945, Vannevar Bush was one of a few visionaries who clearly saw the art of the possible in the use of electronics to coordinate, educate, research and train. His pleading fell largely on a complacent hierarchy more concerned with preserving traditional equities. Though largely unfulfilled over the last 50 years, his words today magnify his intellect and vision even as they indict the timid and the mediocre.

[1] *The Economist*, September 12, 1998, p. 81 is one example of several articles.

Chapter One: Analyzing Educational Technology Requirements

The purpose of this chapter is to discuss the importance of a front-end analysis. It is of particular need when contemplating creation of a Distributed Learning (DL) program because of the recent proliferation of educational technologies that support learning and companies that develop and distribute technology-based solutions. Leading organizations involved in the exploration and application of technology toward learning are struggling with many aspects of their program. Without a thorough front-end analysis, an organization entering the field of distributed learning may easily find itself wasting valuable resources on technology that results in a dysfunctional program not capable of meeting mission objectives.

The first step in developing a DL program is to conduct a needs-analysis, which surfaced as a common, must-do theme found throughout the surveys. This sets the stage for a successful program and helps prevent potential disaster by precluding a misapplication of resources. It is evident from the interviews conducted by Team members that those who believe they have a successful DL program have, at some time, conducted an analysis to determine their individual program's goals. This analysis did not necessarily take place prior to implementation of the program, but, at some point, it was identified and subsequently implemented. If stated goals, as detailed from their analysis, were achieved, they would have a successful program, by their own definition. That is to say they have determined the fundamental reason for the application of resources toward DL.

However, it is also evident that many institutions are still struggling with closing the loop in program analysis, which is clearly portrayed by the on-going question of how to identify and evaluate exactly the key indicators or measures of success to validate their program. They believe their program is successful but cannot always produce tangible evidence. In many respects it is hard to imagine how a program could evolve to a mature state supported by large expenditures of time and funds without an evaluation method or measure of success criteria being established prior to commencement. This is a glaring testimonial for the necessity of not only a front-end analysis but also continual evaluation based on measures of success clearly defined and refined throughout the life of the program. Continual evaluation is the essence of a "living plan".

A needs-analysis is required at all levels--strategic, operational, and tactical. The strategic level encompasses reasons and purposes for program creation and will identify the bounds by which the program will operate. It will also establish the requirement for a front-end analysis. This analysis will determine critical elements of the program and define the criteria for success and how each indicator is attained and measured. The strategic plan will close the loop for the entire DL program. Everything flows from the strategic plan through the operational to the tactical implementation of the program. Hence, a well-defined program with a strategic concept can harvest a coherent program developed from guidance and intent.

A for-profit organization would potentially establish a program to acquire revenue. This program would be of greater ease to evaluate due to the "bottom line". A successful program would, at some point, generate revenue above expenditures, meeting or exceeding a predefined goal. An organization establishing a DL program that is not-for-profit may have a more difficult task at evaluating return on investment (ROI). The ROI may not be as easily measured, may involve intangibles, or may be unusually complicated when considering all the underlying effects. If a clearly established evaluation process does not exist, the program stands to be identified as successful or not successful by different groups based on group interpretation and not by the program's predefined criteria for success. This could lead to constant arguing between groups, which would likely undermine even a successful program.

Another potential problem is that the program would be well underway, with funds expended, before criteria for success was established, thus enabling program developers to determine the base criteria as the program grows. This would constitute a conflict of interest due to justifying DL program continuation based on an in-house evaluation that is, either consciously or unconsciously, designed for continuation and not designed for evaluation based on the program's reason for existence.

Distributed learning deals with electronic technology and is often confused with the fundamental purpose of the program. The goal is not to use electronic technology but to transfer some type of knowledge or ability. A needs-analysis would identify which specific technology or hybrid of technologies needs to be exploited to accomplish the goal for a particular scenario. For example, the technology identified to attain a certain goal may be that of paper-based text. A few years ago, the vision of many programs in their infant stages may have been that of education based on video teleconference (VTC) technology. This technology is easily identified with the traditional industrial age classroom. However, the expense and complications of compatibility, proprietary systems, and other components quickly blurred the once crystal clear vision of exporting the desired knowledge. Many organizations made costly mistakes in their investment into VTC technology. As a result, entities more thoroughly evaluated their programs by going back to square one and completing a needs-analysis. Competing requirements and real world obstacles forced people to maneuver. A solid front-end analysis would have identified reasons and purposes of the program and precluded misapplication of resources.

When developing a DL program, it's imperative that we ask, "What are we trying to do and why?" This simple question, when answered completely, will preclude the waste of valuable resources. Some answers appear and are easy to develop, but evaluation of these answers may not be as straightforward. Continual evaluation of answers, until specific reasons are identified for the steps taken, is necessary to come to a complete solution that solves the initial problem. Remember, a solution to a problem, not creation of additional problems, is desired. Consider the Reserve Component programs.

How to effectively reach the Reserve and National Guard forces with JPME is a question being asked today. A common answer is by leveraging technology. Specifically what and how are we going to leverage technology would be the next question to answer. Different learning activities lend themselves better to different technologies. Is the program an anytime-anywhere- based system, or will it be set on the traditional classroom model? If it is based on the industrial age classroom, can we physically support all the students? The point to be made is there should be a concrete reason for actions taken and the need evaluated in depth. When asked why the DL program is exploiting certain technologies and not others, the program developers should have logical answers. If the response is technology based and not needs based, a review of the program is advised.

How will we know if the program is successful? Another simple query that, when thoroughly researched, will provide insight into how best to evaluate the program. The metrics used to measure program success are addressed in another chapter of this report.

These questions were purposely stated in a simple, easy to understand format to show how basic questions to be answered can be when conducting a needs-analysis. Simplicity leads to clarity, which applies to distributed learning. Keep it simple. Technology itself is not an answer. Don't be dazzled by technology; use it when necessary and when applicable. The goal is to develop a course of action that solves a stated or perceived problem. What exactly is the problem, how will it be solved, and what metrics will be used to measure success? A needs-analysis will help provide the answers and in turn help provide the ingredients necessary for a successful distance learning program.

Chapter Two: The Learner Centric Model for Distributed Learning

"Information technology can make learning available on demand; any subject anywhere, at any time" White House Memo January 30, 1998

There is an increasing need to look at new and innovative methodologies for getting more JPME to more service members, in a cost-effective way; without compromising OPTEMPO or the quality of education. Nowhere was this more evident than at the 21st century warrior conference held in January 1998 at the Naval Postgraduate School. Reiterated at that conference was that officers possessing the talent, intellectual capacity, appropriate experience and relevant education must be continually challenged and motivated by the JPME system. In order to accomplish this, officers must have a firm grasp of their own Service, sister Services, and joint commands. Second, they must have a clear understanding of tactics and operational art; and, finally, an understanding of the relationship between the disciplines of history, international relations, political science and economics. How to best accomplish this is the challenge.

Like the private sector, members of the Armed Forces want information available to them that is useful, relevant, timely and accessible. Academic institutions and corporate organizations are also finding a growing number of their professionals want certification in selected subjects valuable to them (and their employers) in the workplace. There is a desire for educational programs that promise and deliver specific, well-defined competence and skills and are cost effective and convenient. These 'new learners' are driving the education and training communities towards a changing paradigm of delivering "learning". The "any time / any where" aspect of that shift is away from the traditional classroom presentation or 'broadcasting' of learning. The shift is towards a medium of combined "push-pull" technologies that can serve the learner population throughout a "Learning Continuum" (anytime it is needed); from which the learner can expect their cognitive and practical skills to grow. In other words, the method of knowledge transfer needs to be "Learner Centric" vice being convenient for the teacher/instructor. It needs to be more "any time / any place".

Much of the present curricula reviewed by the EdTech Team at academic institutions were for post-graduate level students; in the private sector organizations curricula was being designed for low to upper level managers. Some were step-functions rooted in the old model of educational programs to meet major plateaus in learner development. Much of this regimented education takes place at a centralized time and place.

The problem is there are very few programs throughout an individual's professional life and it is difficult to get all the education required. Many are unfortunate and do not get the few available "seats". We found some continuing education programs were not part of the regular academic program and certainly, for the corporate side, were not staffed by the regular faculty.

There is, however, a growing recognition that if organizations are going to remain competitive and serve their customer base (students or employees) there is an increasing need to re-evaluate their methods for delivering education and training. These new methods of DL are based on a variety of requirements both from the learner's perspective and from a business perspective. On the learner side, Elliot Masie, noted consultant and lecturer, has found in discussions with Microsoft, that businesses are adapting to trends such as:

1. More and more learners do not have the time to sit through lectures on things they already know, nor do they have time to learn things they don't need to know.
2. DL is more about time—when the learner wants/needs the information—and not distance or location.
3. A classroom setting may be necessary for some content, while being supplemented with distributed learning for a different kind of content.
4. Changes are needed in traditional learning models, from a particular event at a given time and place to a model that teaches an individual throughout life. Then our schools and programs need to be proactive and upgrade their content and delivery to ensure it is relevant and timely.

What then are the business drivers? As you might expect, any shift of focus from the traditional 'instructor/facility' centric model would require more than just a philanthropic rationale. This move to a more "learner centric" model, would need to have some payoff from the standpoint of either productivity, revenue or costs.

1. Cost—need to find ways to reduce costs (reducing time to train, travel reduced staffing etc.)
2. Effectiveness—must improve effectiveness and DL is the best way it can be done
3. Accessibility—Global delivery for a global world (borderless economy)
4. It appears that professional education programs using a learner centric model will be part of the business design of any successful institution/organization of the 21st century.

There are a variety of programs being implemented. Many are certificate programs, which normally award the certificate to a student who has completed a specified set of courses, in residence. These kinds of programs are currently losing favor at places like Chase Bank amongst employees who desire additional professional education. Employees dissatisfied with an ability to get convenient on-job education for upward mobility often vote with their feet. These courses are also beginning to change as institutions like General Motors recognize their learner population base needs to expand beyond management to the service department.

New professional programs will promise specific competence and skills, include rigorous project work and testing, and will take as long as the learner needs to obtain a given level of competence. Like DoD, with increased focus on competence and a clientele of working professionals, organizations are finding it is possible to consider DL educational programs at higher levels of competence than are currently being offered. This would allow a level of subject mastery that would normally be associated with later stages of a person's professional career. Developing these programs and making them a regular part of a successful “tactical and strategic” package will be a major challenge for those that recognize, too late, the changing face of the education process.

Richard Saul Wurman, author of the acclaimed *Information Anxiety* and 60 other books, is an architect, graphic designer, cartographer, and creator of the *ACCESS Guide* travel series. He believes there are many great teachers and instructors, but it will be difficult to change from within, there needs to be a catalyst. But there is a revolution of sorts taking place. Companies like the Boeing Corporation and IBM are recognizing that their employees know they are not learning all they should be learning. These companies expend a great deal of resources in assisting employees to get outside education. In addition, they provide their management staff with education, much of which is designed in-house, from within the organization and distributed in a variety of ways , including, intranet, CD-ROM, VTC, VTT to the desk top and web-based courseware delivered via the internet.

These organizations are experimenting, in a sense, with new methodologies for getting knowledge to the learners. They recognize that with increased access to new collaborative technologies and the ability to do teaming exercises and scenario based decision making over the net, old paradigms that required rote memorization and endless reams of paper based notes that became obsolete soon after they were compiled are quickly eroding. The new paradigm that is taking shape is one of facilitating learner access to information. Learners will be able to easily obtain necessary information quickly; allowing them to spend their valuable time thinking about new theories or strategies that will improve organizational productivity or readiness.

Assumptions on how that learning might take place were validated across the spectrum of institutions and organizations. Distributed Learning is being accomplished through a variety of media; including paper-based instruction, interactive multi-media instruction, compressed video, Electronic Performance Support Systems (EPSS) and Virtual Reality (VR) simulations. Most believed that distributed learning and resident courses, are viewed as complementary forms of instruction that enable the delivery of the right mix of instruction at the right time. However, in order to make DL successful, organizations are weighing the necessity to embrace an individual learning model with more sophisticated strategies than merely shifting to more remote teaching. This transition will, no doubt, have wide reaching implications and require that each organization do a thorough review of their own objectives and the role of learner requirements in their long term strategies. Education is said to be the acquisition of knowledge to change thinking. Training is said to be the acquisition of knowledge to change behavior. DL must be a means of enhancing *knowledge acquisition*

At MIT, Dr. Brian Smith has described their program as multi-medium. Trends are developing that will reduce the interoperability problems now faced by users of some types of software, making the delivery of learning more focused on learner requirements. He, like others, sees anytime/anyplace learning as a lifetime model, and indicates the development of cooperative simulations as spawning a new type of socialization at a distance. The MIT program is directed primarily at industry, focused on research, development and building courseware products for open markets. The program, when taken for the degree, comprises 13 courses and a thesis. There is a residency requirement to acquaint the student with the faculty, cohort members of the class, and the support resources available at MIT. Residency is usually completed in a series of short one week “business trips.” Partnerships are negotiated with a host of corporations, creating a mutually beneficial environment of employers who achieve tuition breaks as well as uniform quality and a “lifetime learning” academic culture.

Distributed learning is accomplished via three modes. The first is point-to-multi-point synchronous VTC sessions. The second is non-synchronous videotapes distributed through the mail. The third is web-based instruction, which is the newest element of the program. This hybrid approach is common, especially in higher order cognitive courses.

One model that may be well suited for DoD PME is the MIT process that emphasizes early development of cohorts for networking solutions to course exercises. A unique aspect of this MIT network is that the school actively expands their learner network during and after a programs completion. This keeps MIT looking for new and innovative means of teaming and collaboration, while providing ‘cutting edge’ learning applications that keep former and prospective learners motivated.

Douglas Van Houweling, formerly vice provost for Information & Technology at the University of Michigan and now president and CEO of the University Corporation for Advanced Internet Development speaks extensively on the subject of the changes taking place within education. With so many emerging technologies becoming readily available in the near future, opportunities will exist to extend the successful onsite learning programs that organizations now administer in one or more locations to hybrid programs that have no geographic bounds. Van Houweling zeroes in on the popularity of "real-time" chat spaces on commercial online services such as America Online to make a key point about the management of educationally-based virtual communities. "We need to create opportunities for people to speak to each other and to see each other while looking at the same material. That's one of the things that will really be exciting about Internet2 and the varied communities of interest and academic endeavor that will develop." Internet2 is the follow on to the present web and is currently in testing.

There is now no need to eliminate entire cadres of potential learners from the educational process. Van Houweling says it is becoming increasingly possible "to give students the option to access knowledge in a broader array of learning styles that includes distance education, and multimedia along with collaborative research and discovery techniques." Information systems will be in place to perform all student management functions (enrollment, track performance, courses completion, certifications and awards, etc.) of resident curriculum and distance learning environment. These systems will capture data on job performance aids in the network environment, monitor Interactive Multimedia Instruction (IMI) warehouses, as well as collect and support the analysis of IMI measures-of-effectiveness (MOE)/Measures of Performance (MOP). They will also provide state-of–the–art tools for curriculum development, and interface with the service developed enterprise-wide systems, including operations planning.

The DL strategic plans now being sold to upper management are based on timeliness, instant access and accessibility to the thousands of small remote offices. In the Chase Manhattan Bank network, the “opportunity cost of training” was a major factor in selling management on the need for continuous training in the highly competitive banking environment.

Like colleges, universities and the business sector there is a new generation of learners, to contend with in DoD. They are adept and comfortable with videogames; multi-tasking is a way of life and attention spans can be short if the content is not relevant to the tasks at hand. They are comfortable exploring new mediums of content and delivery. DoD may be able to leverage what is being accomplished in the private sector, as it may pertain to the delivery of PME. There are opportunities to enhance the delivery of PME by providing enrichment tracks of enhanced content in the operational art of war. Using emerging technologies can facilitate the efforts of the war colleges in doing what they do best; providing for in depth study of joint and coalition development of policy, strategy, and operational art. Collaborative technologies are emerging which will allow the development of student skills in gaming, testing, and evaluating hypothetical new combat systems that respond to perceived strategic and operational trends and technological requirements.

In many organizations, DL was found to be is a big part of their strategic plan. Nowhere was that more of an issue, than at the Defense Acquisition University (DAU), where they have a widely spread learner population. Their ultimate goal is to run the entire university over the web. DAU is responsible for providing education and training for more than 170,000 people in the Defense Acquisition Workforce. Online courses are student-centered. Students can proceed at their own pace and complete lesson blocks at their convenience during a 60-day window. The courses were designed to be taken during the day at work, so they do not include audio or video that may distract others in the workplace. However, these features may be included in the future and will require that all systems have a sound card and other audio/video capability.

DAU plans for the instructor(s) to be available at certain times during the courses for chat sessions and/or email. This is a daunting task that requires cooperation and support from 12 DoD educational institutions and several contractors. Providing this learning over the web will enable them to certify more students in less time, while alleviating long waits for certain courses. They also see the potential for reductions in facilities and manpower. Their primary interest is to get more education to those that need it when they need it, but they are also looking at this opportunity from a business perspective.

The Graduate School of America offers DL as a cost-effective means by which to provide its students graduate-level degrees. It also permits the institution to more carefully structure its courses so that it takes into account the different learning patterns of the adult learner.

Additionally, since most of the learners are working professionals in the area, channeling those experiences into practical applications of the area's theory becomes another role for the mentor and area chairperson. Their program is based on the belief that high quality asynchronous delivery and response is possible, due in part, to the fact that the DL environment allows the student to think out responses more carefully and with greater reflection. Additionally, the student shows more care in the overall packaging and/or writing of submissions.

Many of the organizations visited are using a hybrid approach, but are still focused on the learner. Indiana University's program is all encompassing, involving satellite transmissions, videotape, CD ROM, correspondence, internet, IU's interactive video network (the Virtual Indiana Classroom, or VIC network), IHETS (Indiana Higher Education Telecommunication System), television, and videotape.

It is dedicated to providing learning that's available to students in campus classrooms, residence halls, students' homes, or the workplace. Location is not seen as a constraint. The program is included in the strategic plan due to the Institution's commitment to provide quality learning experiences to students who cannot come to the campus for regular classes. Indiana University believes in the value of information technology to the fields of teaching and research and believes it should be brought into all disciplines where deemed appropriate to do so.

Advances in weapon systems bring increased complexity, which along with changes in expected conflict scenarios, have significantly increased the performance demands on human operators. The requirement to provide relevant JPME expeditiously becomes more difficult as the information environment continues to change. Modern battle management systems require operators to receive, process, and combine unprecedented amounts of data in time compressed situations, where both inter- and intra-ship/squad/system team coordination is required. High workload, situation ambiguity, and time compression combine to create a difficult and stressful environment.

To effectively operate in this environment, tactical decision-makers must maintain and have access to a large store of information, including the capabilities and limitations of their systems, the current geo-political situation, and a large body of rules, procedures and contingencies. The decision-maker must use this tactical knowledge to quickly identify friendly and threat assets, to assess the tactical situation, and to effectively apply the appropriate doctrine, tactics, and rules of engagement in high-risk, time compressed situations.

The educational environment of the future will consist of many faculty/instructors without classrooms. The virtual classroom will become more common. Desktop simulations, to expand mental vice physical skills, will eliminate the need for many resident courses or modules. As strategic and tactical education is transported to the fleet, budget and mission requirements will dictate that the service members career development be as flexible as the information environment within which it exists.

When combined with synthetic environment training systems, distributed training technologies and classroom modernization initiatives, DoD has a tremendous opportunity to exploit the private sector “lessons learned” and leverage amongst the service resources. This will allow them to deliver cost effective, quality PME education to a larger population of right people, at the right time, and at the right place; well into the 21st century.

Chapter Three: The Technology Toolbox Approach to Distributed Learning

How many times have you heard the phrase, "Use the right tool for the job"? This is sage advice, tried and true. A skilled craftsman has more than one tool in his toolbox. While he may get away with using a pair of pliers to loosen a nut instead of using a socket and wrench, the results are not optimal. The same is true for technology and its application to distributed learning (DL). There are many forms of DL and one technology, no matter how powerful or pervasive or leading edge, does not produce optimal results across the board.

Fortunately, the DL and educational technology communities at large recognize this concept. In almost all interviews and site visits, this area was discussed at some level. Everyone expressed a desire to use the right technology tools based on the learning requirements. However, more importantly, they also realized there are many technologies available and it is a matter of available resources balanced against learning requirements. In other words, do you really need the latest and greatest $2000 table saw when a $10 handsaw will do? This chapter describes the concept of using a technology toolbox approach to DL and how an institution can choose the right tool for the job.

This approach to solving DL problems views various technologies as tools in a box. Interviews and site visits have shown that many useful tools are available—it becomes a question of which tool to use. There are several factors to consider when choosing the right technology tool for DL. According to many experts interviewed, the most important factors are the learning requirements. For example, does a particular learning objective really require extensive interactive graphics or will a few pictures and text suffice? The experts also generally agree that institutions should not embrace new technology for technology's sake. Dr. Richard Hezel of Hezel and Associates, a consulting company specializing in DL, described some recent fads in DL technology. He said that in the early 1990s, 1-way video was most popular. In the mid-1990s, 2-way video became the rage. Today, it is the Internet. Current Web-based programs are mostly text and graphics, but as bandwidth increases, Dr. Hezel predicts a shift to video/audio and by 2003, he maintains that we will see more synchronous instruction over the Web.

However, he sees these fads arising from a toy store mentality, not genuine requirements. He argues that very few organizations perform a media analysis before choosing their delivery method—they just go with what's hot at the time. He stressed that good use of telecommuni-cations requires good planning, including both a front-end needs assessment and a business plan. He also indicated that market-driven programs will require providers to be sensitive to the needs of the learners as well.

However, available resources and institutional commitment will limit even the best thought-out requirements. A major question to ask is "What available resources does an institution want to spend on DL?" For example, in some DL cases, such as detailed training required for equipment repair, extensive and highly detailed graphics are required. It may be somewhat expensive in terms of resources to produce and deliver this material; however, the responsible institution may recognize a great need for this training delivered this way.

They may also recognize the potential for long term return on investment. In any case, requirements must be balanced with resource costs. The Team found that leading edge technology for DL is already available—what do you want to do and what are you willing to pay for it? The next section describes some institutions that know what they want and are willing to pay the price to accomplish their mission.

The DL program for non-resident learners at the Army War College (AWC) is an excellent example of the technology toolbox theme. According to the site interview, this program focuses on seven areas: text-related technology, student technology requirements, student deliverables, administration, Internet, streaming multimedia, electronic source material, electronic references, and interactive desktop video-conferencing. However, the primary vehicle utilized by AWC to carry out its DL program is the Internet.

The AWC indicated that the printed page would remain a commonly used medium. However, electronic references, to include publications and databases, will be used when available over the Internet or on CDs. Additionally, radio and television broadcasts, audio tapes, and videodisc or CD-based material will replace or supplement, as appropriate, print-based products. Desktop VTC over the Internet that offers continuous presence and multipoint capability will play an increased role in the AWC's program. Possible transmission links will involve satellite, fiber optics, and plain old telephone service using 28.8K or slower modems.

Another area that requires the application of different tools is bonding. According to the site report, the AWC acknowledges the value of bonding, but they do not believe bonding takes place only in face-to-face situations. They feel that chat groups, student/class groups, threaded discussion, email, and VTC, can also provide an environment that nurtures affective behavior. However, the AWC also brings students together at the start, middle and end of the program for interaction. In addition, the AWC is exploring the idea of bringing new students to campus prior to the official start of each new class for instruction on new technology.

The AWC is currently focusing on the implementation of its DL program. Given the highly positive goals of their DL initiative, they plan to embrace and implement whatever technology exists that will further advance their goal of offering learning to the widest-possible student base. They also plan to make it available at the site and time of the student's choice.

Another institution, Chase Mortgage, is investigating increased use of Web-based methods to supplement VTC. They document savings of distance learning costs over previous classroom-based instruction at about $150-$500 per site per training day. However, their VTC costs are rising. Over the past year, Chase Mortgage saw their contractor raise his price by over 150% for the same services. Evaluation of whether VTC, as opposed to other DL tools, is the best means of education and training is continuing.

Carnegie Mellon University's program encompasses all forms of technology for application in distributed learning. Their technology tools include CDs, the Internet, on-line chat rooms that allow instructor-led synchronous delivery, email, electronic bulletin boards, satellite broadcast, and print.

This university uses a variety of accepted media such as CDs, videotapes of lectures, videoconferencing, the Web and chat rooms, and a specialty application known as "Just In Time Lectures." The later is a hybrid tool involving Web-based links and video segments that have been placed on CD.

This university also believes in the value of face-to-face interaction for the purposes of bonding. In fact, its Information Resource Management Certificate Program requires a face-to-face seminar at the start of every new class. However, chat rooms, a Web-based student lounge, and email are commonly used tools for facilitating bonding. They also use T-shirts, mugs, and other give-aways to help establish a sense of cohesion among the DL students.

Another excellent example of using the right tools for the job is Stanford University. According to their Web-site, they have offered working engineers and computer science professionals the opportunity to continue their education through a distance learning program called the Stanford Instructional Television Network (SITN), in the School of Engineering, for nearly 30 years. The SITN continues to deliver top-ranked graduate education to member company sites, broadcasting more than 250 Stanford engineering courses to more than 200 corporate sites.

Their Web-site goes on to describe another related project called Stanford Online. This project makes Stanford engineering and computer science courses available anywhere, anytime, and on-demand in order to accommodate the needs of busy professionals. The flexibility built into Stanford Online has significantly changed and improved access to Stanford research and courseware, while at the same time creating new education and training methodologies for continuous learning.

According to their Web-site, many university-based DL programs around the world are experimenting with Internet-delivered education and training, but Stanford University is the first to incorporate video with audio, text, and graphics through Stanford Online.

Stanford Online classes are currently selected from the SITN schedule. They are digitized and compressed and then stored on a video server, making Stanford classes available to company-sponsored students as well as campus students in an on-demand, video-streaming environment. Students can ask questions or otherwise interact with the instructor, teaching assistant, and/or other students asynchronously from their desktop computer. The SITN has nine television classrooms with full schedules of graduate level engineering and computer science courses. The format of Stanford Online creates a desktop environment for the student that incorporates video at 10 frames per second over the Internet, as well as surrounding applications on the computer that work together in a synchronized manner.

The experience to date of Stanford Online is that there are significant benefits in the use of asynchronous on-demand delivery to the computer workstation that warrant continued advances. These benefits include increased course access for working professionals, increased quality of the educational and learning experience, and potentially lower costs for both the educational institution and the company participants.

On the other hand, some institutions, such as the Defense Acquisition University, have targeted one major technology tool for all of their courses in the future—The Internet. According to the DAU interview, they want their courses to be completed over the World Wide Web as much as possible. However, they do acknowledge the Web is just one of many tools. They realize face-to-face interaction in a classroom will be a necessary requirement for some of their higher level team building courses. Even so, they are looking at how this collaboration can be accomplished over the Web using interactive chat, threaded discussion boards, and email. Which tool they use will depend on the unique requirements of the individual course.

The technology toolbox approach to selecting and using media is a valid construct. There are numerous possibilities from which to choose. For as consistent in the survey findings as was the belief in this approach, similar consistency was found in the belief that simplicity is often the best approach to take in distributed learning.

The University of Wisconsin, for example, which has a 110-yr history with distributed learning via correspondence programs, has been successfully using audioconferencing for 35 years. The decision to use this media was predicated on a simple principle—the understanding that not all of their distributed learning audience has the equipment required for participating in higher order media. Reportedly, this technology has proven quite successful both from the faculty and student perspectives.

At the University of Idaho, the medium of choice for delivery of its graduate level engineering courses is the use of videotaped sessions of classroom instruction, although, like the University of Wisconsin, other popular media are also used in their respective distributed learning programs. Again, as with Wisconsin, the choice of videotape was a conscious one, made in part due to a realization that not all of its students have the requisite equipment necessary to work in a more computer based environment. Equally important in its decision to emphasize videotape was the fact that its student population, which largely consists of professionals working in engineer-related fields who travel frequently with their jobs. The use of videotapes is desired on their parts inasmuch as they can usually find VCRs in hotels and can view class sessions on the road. This approach has served the needs of the University and its students quite well, again emphasizing simplicity.

In a similar but different initiative from Idaho's, North Carolina State University has taken a more direct approach to distributed learning through the use of its VideoClass System in which lectures are videotaped, edited on the fly and distributed, primarily, over cable TV systems. These programs are dynamic in presentation and style and offer TV techniques such as split screens, effects, etc. The faculty member working in this environment merely has to instruct. The production work is done for them. The program is so successful that the rooms are booked for two years.

An important consideration in any tool selection is instructional design and desired outcomes. Across the survey boards, the importance of up-front design and focus on content was emphasized, and it was agreed that content should not be sacrificed for technology. As a bottom line look at technology tools, it is important to take note of the studies done by Tom Russell, Director, Instructional Technologies, North Carolina State University. Russell is a highly esteemed researcher and writer in the field of distributed learning and was quoted numerous times during surveys for his controversial yet realistic look at distributed learning—"No Significant Difference.'' As Russell pointed out during an interview and as stated in his studies, students learn equally well with each technology used, whether in the classroom or in a distance learning environment. Low tech or high tech, interactive or not, his findings, which have been drawn from over 800 separate studies, indicate that the technology tool chosen, for the most part, just doesn't make a significant difference. Good instructional design does. Technology doesn't make bad instruction better; it only makes it easier or faster to promulgate it.

This theme could go on for pages because the Team interviewed and visited many institutions that subscribe to the technology toolbox approach. The examples above are some of the more outstanding ones. The key is that few perceived problems were unique and thus far, most can be solved with the proper tool.

To conclude, in this analysis, the institutions that are successful in DL are using some form of the technology toolbox approach. They are willing to invest available resources in building toolboxes with just the right mix of tools for their particular situations. In other words, they apply the right level of technology to satisfy the learning requirements. The technology for DL is there, it is alive and robust and growing every day. What tools do you want in your toolbox and how much are you willing to pay?

Chapter Four: Evaluation in Distributed Learning

Evaluation. The mere mention of this innocuous word seems to send a chill up the spine of students and faculty alike. For students, it is a chill because their candidacy for graduation depends upon satisfactory completion of some type of evaluation. For faculty, it is a chill because of the pressure to have successful programs with "success" being defined by some type of evaluative process. And yet, evaluation is the lifeblood that enables institutions to engage in continuous process improvement. It is the vehicle, by which feedback is sought, collected, analyzed and then applied to refine a given program. Educational evaluation is a systematic process of judging how well individuals, procedures or programs have met the educational objectives. Thus, evaluation is an extremely important part of the learning process. It is not by coincidence that it culminates the five steps in the instructional system design process.

The survey used in this study asked nine general questions on evaluation ranging from "How are you measuring success?" to "Do you plan on changing your program?" While these questions seem straightforward, it became obvious the questions were subject to interpretation, and thus, in some ways, were too broad. Consequently, some of the responses received were vague or so shallow that it was difficult to draw any meaningful conclusions from them. In addition, on the topic of evaluation responses were received from only half of those interviewed further limiting the ability to assess trends and predict patterns. There were legitimate reasons for the lack of responses.

In some cases, interviewees were consultants or representatives of professional associations who do not deliver courseware, and thus, do not have an educational program to evaluate. Other institutions were in the infancy stages of their distributed learning programs and had not yet implemented an evaluation program though they certainly intended to do so. In still other instances, the interviewers chose to bypass some of the nine questions in the interest of time in order not to miss larger, uncovered topics. Thus, what follows is based upon a very small set of responses to the nine questions. Nonetheless, there exist some findings and recommendations that may prove useful for the subsequent phase of this Joint PME 2010 study.

A few general comments about the peculiar impact distributed learning has on the evaluation process are in order. Evaluation here is assumed to mean more than merely looking at end-of-course tests. First, distributed learning programs are inherently more difficult to evaluate. This can be attributed to any number of factors, which could include the novelty of the program and thus, the lack of any standardized procedures or models to use. Other variables may be the lack of any faculty/instructor training for this non-traditional approach, or the simple fact that technology brings to the table unanticipated variables that can easily complicate evaluation processes. Next, the design of a distributed learning program will influence when and how the instruction and evaluation will take place. Similarly, the media used may impact the design and implementation of the evaluation. Thus, as Chris Sharp has already pointed out in Chapter One, a thorough needs assessment backed by a solid media selection are absolutely critical to designing a successful program with effective evaluation tools. Lastly, the learners' attitude and motivation will influence their evaluation. So, evaluations must go beyond the traditional questions and specifically ask about perceptions, attitudes and the support they received during the course to have meaningful data on distributed learning programs. Distributed learning demands an evaluation program that is student-centered.

The interviews uncovered that distributed learning programs are compared—rightly or wrongly—to traditional programs. So metrics like student performance, retention, enrollment and success rate are thoroughly tracked while metrics characteristic of distributed learning such as student attitude, participation and quality of interaction are often ignored. Indeed, most distributed learning evaluation programs rely on traditional tools to measure learner effectiveness. Ironically, even though the non-traditional students typically do as well or outperform their resident counterparts, few institutions surveyed have made any attempt to revise their evaluation system to determine how or why this is. Obviously, such data could also be used to redesign traditional programs to enhance learning outcomes.

Because of the growing dissatisfaction with the heavy reliance on end-of-course tests and student feedback as the sole tools for measuring success, institutions are now pursuing other indicators. The Defense Acquisition University, for instance, does not assign traditional grades, but rather, trains to levels of certification. In addition, they intend to survey the graduates and their supervisors, to help determine course effectiveness. Similarly, the *New York Times* tasks the supervisor to determine the success of the course through an informal evaluation of their subordinate's performance. Indiana University places strong emphasis on competency or outcome-based results. Competency exams can easily lead into certification programs. Dr. John Bear now reports of more than 700 certification programs available worldwide. Dr. Ted Christensen from George Washington University predicts the greatest growth of distributed learning will be in certification programs.

Though important to professional military schools, most institutions interviewed for this study do not evaluate the learner's potential for growth. Like many schools, the University of Idaho assumes growth is an inherent part of the student profile since they are, after all, graduate students. They argue that growth potential can be surmised through the quality of the student's work, feedback and assessments. Other schools essentially evaluate growth through basic entrance scores. The Graduate School of America noted that most of their students are self-directed and highly motivated who have already established themselves as career professionals. They are, however, investigating the use of a self-directed learning scale tool as a possible evaluation mechanism to measure growth potential.

What, then, are some of the evaluation methods and tools which show great promise for the JPME system? Well, there are a number of exciting approaches that are noteworthy. Chase Bank's performance-based testing using vignettes to ensure competency is representative of the shift from one-dimensional, rigid processes to more interactive, dynamic and fluid processes. Carnegie Mellon University has developed a series of programs that both assess and remediate the learner striving to recreate the Socratic approach. They are also pursuing technology solutions that allow one-on-one instruction with correction. This emphasis on individual learning styles was echoed by academic and corporate institutions alike and evidenced by programs that a few were offering via different media.

Metrics unique to distributed learning courses and in use by organizations surveyed included the quality of interaction between the student and student, versus student and faculty. Faculty perception and feedback was of equal importance, a clear indication that academic institutions recognized that the future of programs is tied, in part, to faculty acceptance. Other evaluation factors unique to the distributed learning environment was the emphasis on student support services, access to the learning technologies, and training for students and faculty on how to use them. There was clear evidence that as institutions become smarter in their understanding of how people learn, they'll tailor their instructional design to match. There seemed an implied commitment to modify the evaluation process to reflect new learning theories as well.

In conclusion, it is clear that institutions are struggling with the paradigm shift demanded by the distributed learning environment. Equally clear from the interviews is that distributed learning has not yet been normalized into established education and training evaluation processes. As education and training programs shift to learning by doing and storytelling concepts, so must their respective evaluation systems. Evaluation tools must evolve in concert with the technology to ensure learning outcomes are met. And just as there is collaboration in educational development, so should there be collaboration in education evaluation. Successful learning must be the ultimate goal of all education and training programs, regardless of the delivery method.

A few recommendations may be in order. As the various institutions charged with delivering joint professional military education migrate to the emerging learning technologies, it is imperative they establish learning and other outcomes before selecting a technological solution. Programs must be requirements driven, not technology led. Equally important is the need to design distributed learning programs with students in mind, since the paradigm shift is to learner-centered programs. This will require a shift in evaluation tools from tests to outcome-based results. Course designers would enhance the effectiveness of their programs by doing site visits and testing the evaluation tools before implementing them. They need to include learner support services in the program. Finally, all institutions must ensure a process is established to evaluate successful distributed learning programs so institutions offering the same program in a traditional setting can benefit.

Chapter Five: Learning Domains Employed in Distributed Learning

The EdTech Team was tasked to benchmark the best practices in academia, industry, and military education and training and identify trends for the future of educational technology and distributed learning media. Together with a team performing a requirements analysis, this constituted the initial part of a three-phase planning process. If justified by the requirements analysis, the next phase will include the development of courses of action to rectify any gap between the current state of JPME and the end-state derived from the requirements analysis. The final phase will include seeking approval within the Department of Defense (DOD) and, ultimately, from Congress. An essential element of that approval process will be meeting the congressional intent of existing policy as delineated in both the Goldwater Nichols Act and the Skelton Panel. A key element of any plan to alter the JPME process must account for the requirement to develop a "Joint Perspective." This highly affective learning objective will be addressed below.

Cognizant of these planning concerns, the EdTech Team identified learning domains as a key element of the benchmarking process. Content of any instructional approach will fall into one or more of three learning domains: Cognitive, Affective, and Psychomotor. The benchmarking process sought to determine which medium or media were used to best convey the learning requirements of these domains. Each of the three domains will be addressed below to include discussion of the learning domain itself, delivery media applied, and potential application to the current learning objectives of JPME. The first is the cognitive domain.

Within the cognitive domain, learning is demonstrated by knowledge recall and intellectual skills such as comprehending information, organizing ideas, analyzing and synthesizing data, applying knowledge, choosing among alternatives in problem-solving, and evaluating ideas or actions. A review of the Officer Professional Military Education Policy (OPMEP) shows that this domain is predominant for JPME learning objectives.[2] Benjamin Bloom identified six levels within the cognitive domain, from the simple recall or recognition of facts, as the lowest level, through increasingly more complex and abstract mental levels, to the highest order, which is classified as evaluation.[3] Bloom's taxonomy proposes the following hierarchical approach to this domain (listed from lowest to highest):

1. **Knowledge**: the remembering (recalling) of appropriate, previously learned information.
2. **Comprehension**: Grasping (understanding) the meaning of informational materials.
3. **Application**: The use of previously learned information in new and concrete situations to solve problems that have single or best answers.
4. **Analysis**: The breaking down of informational materials into their component parts, examining (and trying to understand the organizational structure of) such information to develop divergent conclusions by identifying motives or causes, making inferences, and/or finding evidence to support generalizations.

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[2] Chairman, Joint Chiefs of Staff Instruction 1800.01, *Officer Professional Military Education Policy*, dated 1 March 1996.

[3] Distance Learning Resource Network, http://www.wested.org/tie/dlrn/blooms.html

5. **Synthesis**: Creatively or divergently applying prior knowledge and skills to produce a new or original whole.
6. **Evaluation**: Judging the value of material based on personal values/opinions, resulting in an end product, with a given purpose, without real right or wrong answers.[4]

Cognitive learning is the most common of all learning domains. Each of the academic, industrial, and military institutions interviewed were offering multiple programs in this domain. Delivery media ranged from the traditional face-to-face classroom to the full spectrum of current distributed technology including CD-ROM, videotape, videoconference, web-based applications, chat rooms, email, threaded discussion, audio conference, electronic bulletin boards, print, streaming video, multicasting, interactive TV, electronic performance support systems (EPSS)[5], ASK systems[6], and virtual reality. All programs reported success with their respective programs in this domain.[7]

The application of these media varied considerably. Programs ranged from traditional face-to-face lectures supplemented with technology (email, chat rooms, etc.) to totally independent formats relying completely on technology for all facets of the program. These independent formats fell into two broad categories. The first was a distributed version of the traditional pedagogical paradigm—material is presented and learning is assessed and graded. Technology is used to do the same things as before with the added ability to reach out to distant learners or allow asynchronous participation in a learning program. The other category represents a paradigm shift. In these programs learning is scenario or case-based for experiential learning. Virtual reality and ASK systems are two of the more innovative media applied to this area and have tremendous potential for further exploitation. Next, there is the affective domain.

> For the affective domain, learning is demonstrated by behaviors indicating attitudes of awareness, interest, attention, concern, and responsibility, ability to listen and respond in interactions with others, and ability to demonstrate those attitudinal characteristics or values which are appropriate to the test situation and the field of study. This domain relates to emotions, attitudes, appreciations, and values, such as enjoying, conserving, respecting, and supporting.[8]

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[4] Major Categories in the Taxonomy of Educational Objectives (Bloom 1956), (http://weber.u.washington.edu/~krumme/guides/bloom.html)

[5] An EPSS is an embedded learning support tool that provides just-in-time instruction focused on the task at hand.

[6] ASK systems were developed at Northwestern University's Institute for the Learning Technologies (ILS). This architecture depends on two ideas: experts are repositories of cases, and good teachers are good storytellers. Case-based systems tell students exactly what they need to know, when they need to know it. When students learn by doing, they experience knowledge failures-times when they realize they need new information to progress. Case-based teaching provides that knowledge. The ASK system employs an indexed database of video clips of subject matter experts. These clips are associated with questions learners are most likely to ask and not only respond to the question, but provide a new set of related questions the learner can draw upon.

[7] The concept of *success* was not uniformly well defined.

[8] Distance Learning Resource Network, http://www.wested.org/tie/dlrn/blooms.html

David Krathwohl's taxonomy of the affective domain addresses a hierarchy of personal, interpersonal, and cultural values such as follows (listed from lowest to highest):

1. **Receiving**: Being aware of or attending to something in the environment.
2. **Responding**: Showing some new behaviors as a result of experience.
3. **Valuing**: Showing some definite involvement or commitment.
4. **Organization**: Integrating a new value into one's general set of values, giving it some ranking among one's general priorities.
5. **Characterization by a value or value complex**: Acting consistently with the new value.[9]

Affective learning within JPME has a smaller but vital role in the learning objectives of the OPMEP. Specifically, only the Industrial College of the Armed Forces (ICAF) and the Armed Forces Staff College have formal affective learning objectives explicitly delineated in the OPMEP. ICAF students are expected to "Internalize a thoroughly joint and interagency prospective as an element of personal and professional development." Similarly, AFSC graduates are expected to "Demonstrate a thoroughly joint perspective and comprehension of the increased power available to commanders through joint effort and teamwork."[10]

Vice Admiral Blair, the Director, Joint Staff, has stated that these learning objectives "express the idea which I believe lies at the heart of successful joint operations, both now and in the future."[11] Echoing the Admiral's comments, proceedings of the Professional Military Education for the 21st Century Warrior Conference identified the ability to work comfortably with and know other service cultures as a desired quality of the 21st Century Warrior.[12] The Preliminary Summary Analysis of the Conference stated that JPME "provides conditions conducive to the development of inter-service contacts among officers and the resulting trust that facilitates joint action of the armed forces as a unified team of land, sea, air, and marine forces."[13]

The affective learning element of the AFSC mission has its origins in the Goldwater-Nichols National Defense Reorganization Act of 1986 and the Skelton Panel of 1989.[14] It was congressional intent that this joint perspective be accomplished at AFSC through complete immersion into a joint environment through academics, sports, and living accommodations.[15] This immersion includes a student body and faculty that are both equally represented by all Services. Metrics from the resident Phase II JPME program at AFSC measure the students' perceptions about their confidence in the following four affective criteria:

1. Being a member of a joint team.
2. Communicating with members of other Services.
3. Integrating the Services' capabilities and limitations for mission accomplishment.
4. Accuracy and usefulness of products developed by members of other Services.

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9 Adapted from: Krathwohl, D., Bloom, B., & Masia, B. (1956). Taxonomy of educational objectives. Handbook II: Affective domain. New York: David McKay

10 Chairman, Joint Chiefs of Staff Instruction 1800.01, *Officer Professional Military Education Policy*, dated 1 March 1996.

11 VADM Dennis C. Blair, Professional Military Education for the 21st Century Warrior Conference, Naval Postgraduate School, Monterey, CA, 16 January 1998

12 Draft Notes on the January 1998 Professional Military Education for the 21st Century Warrior Conference http://web.nps.navy.mil/FutureWarrior/mecc-wg.html

13 Preliminary Summary Analysis of the Conference on Professional Military Education for the 21st Century Warrior, http://web.nps.navy.mil/FutureWarrior/Analysis.html

14 Report of the Panel on Military Education of the One Hundredth Congress of the Committee on Armed Services, 101st Congress, First Session, 21April 1989.

15 A. Barrett, 25 September 1998

These values are measured at the fourth, tenth, and twelfth weeks of the twelve-week program. Data, as displayed in Figure 1, shows statistically significant increases at all three points implying that the acculturation process is well supported by an extended, face-to-face program.[16]

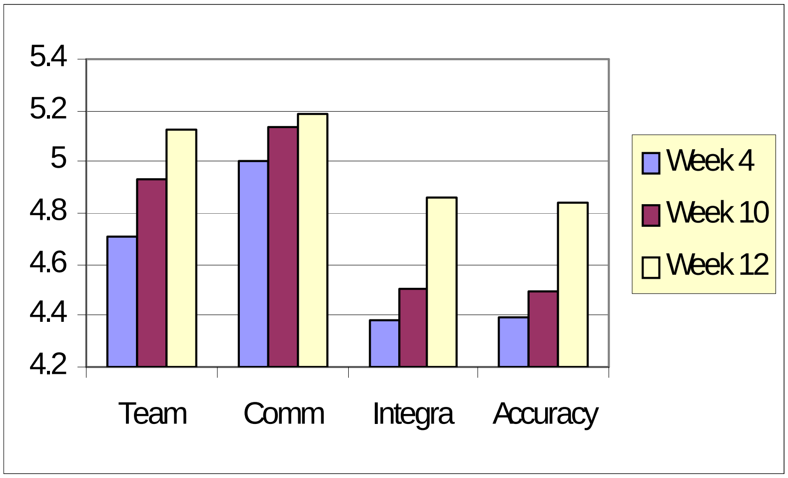

Figure 1

For distributed learning programs observed in this inquiry, affective learning was less ubiquitous than the cognitive domain. One third of the institutions interviewed did not offer explicit evidence of operating in this domain. Of those institutions that did report affective learning, the majority focused on some form of bonding to group, corporate, or classroom norms.[17] Other affective applications were in programs focused on ethics, counseling, and customer relations.[18]

Media in the affective domain were considerably more limited than those used for cognitive learning. They included ASK systems, email, chat rooms, threaded discussion, video conferencing, and web-based applications. It is particularly noteworthy that 83 percent of the affective learning (Figure 2) reported involved some form of face-to-face engagement between and among students and faculty.[19] This face-to-face element was deemed necessary for learning objectives ranging from higher-level team building courses to practitioner-oriented clinical experience.[20]

ASK systems were employed in at least two cases to present ethics courses.[21] By using the indexed database of video clips, these courses were able to engage learners and immerse them in a scenario where they had to make critical affect-laden decisions. The use of these virtual video experts with sophisticated branching capabilities for affective learning objectives is a capability reported by three academic institutions: Northwestern University, Carnegie Mellon University, and the Massachusetts Institute of Technology.

[16] James Poole, Educational Assessment Division, AFSC, 23 September 1998
[17] University of Central Florida, New York Times, and Boeing
[18] Carnegie Mellon University, Graduate School of America, and Chase Manhattan Bank
[19] Examples include US Army War College, Lucent Technologies, and the University of Central Florida
[20] Defense Acquisition University and the Graduate School of America
[21] Carnegie Mellon University and the Institute for the Learning Sciences at Northwestern University

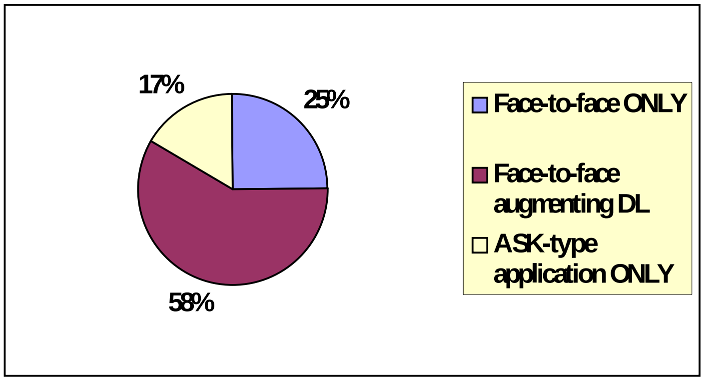

Figure 2

Michael A. Moore, of Pennsylvania State University, referred to the classroom as just another presentation medium, adding that it just happened to be the most expensive medium. Email, chat rooms, threaded discussion, video conferencing, and web-based applications are seen by a number of institutions to be economic multipliers that could reduce the demand for face-to-face classroom experiences.[22] The goal is to develop these other media in the affective domain to minimize the expense of facilities, travel, and lodging that are an inherent part of face-to-face presentation.

Those who are using distributed media for affective learning emphasize the importance of interactivity. These students routinely operate in a virtual community of learning where they can exchange ideas and socialize just as they do in the brick-and-mortar version. However, a recurring theme in this environment is that the group size must be controlled and there must be a high degree facilitator interaction for each group of learners[23]. Moore suggests that group sizes of six to ten are considered optimal, with groups of twelve to fifteen appearing to mark the upper limit for effective affective distributed learning.

A final common theme was the use of face-to-face sessions of a few days or more to open a distributed program. The interpersonal bonding common in a normal in-residence program gets a "jump-start" in this opening session. Then, during the distributed portion of the program, there is already an awareness of others who are participating remotely. The US Army War College further supplements this bonding process by incorporating student biographies and pictures into their web site. Finally, there is the psychomotor domain.

The psychomotor domain of learning is demonstrated by physical skills. Such things as coordination, dexterity, manipulation, grace, strength, speed; actions which demonstrate the fine motor skills such as use of precision instruments or tools, or actions which evidence gross motor skills such as the use of the body in athletic performance.[24] Since there are no psychomotor learning objectives for JPME in the OPMEP and only two of the institutions interviewed by the Educational Technology Team addressed any psychomotor elements there will be no discussion of this domain.

Three conclusions can be readily drawn from the analysis of learning domains. The first conclusion is simply a reinforcement of the literature that tells us that when programs are properly developed and learning media properly applied there will be no significant difference in student performance and satisfaction when compared to traditional media. JPME learning objectives, particularly the cognitive objectives, can be effectively accomplished via distributed media. The critical element will be ensuring the proper design and implementation of such programs.

A second observation is that affective learning appears to be achievable via distributed media. There are, however, some concerns when 83 percent of the programs

[22] Examples include Defense Acquisition University and the Graduate School of America
[23] Michael A. Moore interview, 16 September 1998
[24] Major Categories in the Taxonomy of Educational Objectives (Bloom 1956), (http://weber.u.washington.edu/~krumme/guides/bloom.html)

surveyed relied on some element of face-to-face learning to achieve the desired learning. Additionally, the need to keep learning groups small and facilitated will require a significant infrastructure and administrative overhead. With the importance that the senior leadership and Congress have placed on developing a joint perspective, it will be essential to develop a program that employs the proper mix of face-to-face and distributed learning media that achieve the required affective learning.

A final observation involves a learning medium: ASK systems. This technology appears to have tremendous potential for creating a rich context that allows for learner immersion into the subject matter. The Institute for the Learning Sciences points out that most senior leaders believe that their organizations would be better if junior personnel had the benefit of their experience. Conversely, the senior leadership has the least available free time to be able to share that experience. By using an ASK system JPME would be able to catch the experience of the senior leadership as well as the lessons learned from junior planners.

In the final analysis, it is obvious from our data that distributed media can be effectively employed to meet any cognitive learning requirements for JPME. For affective learning the Team benchmarked an interest in applying more distributive media, but there is insufficient success to date to support any assertion that distributed media can wholly supplant face-to-face interaction. However, that does not mean that distributed media cannot be used to reduce the face-to-face time currently required.

A well-designed program, following instructional systems design principles, will adopt a medium or combination of media to effectively meet learning requirements—regardless of learning domain. The media may be a low technology face-to-face approach or may be at the very leading edge of technology. The medium is not the message. It is the learning that is important.

Chapter Six: Faculty Considerations in Distributed Learning

Distributed learning (DL) via the web is the modern educational technology successor to the older correspondence courses and synchronous video teleconferencing systems that have been around for some time. Web-based DL is arguably the manifestation of the "Revolution in Business Affairs" applied to academia. That is it is the manifestation of knowledge-sharing "any time / any place." This study found that central to successfully operating a DL program is getting the faculty to "buy in" to the new initiative. Faculty resistance has generally been significant, if not fatal for many programs because faculty concerns have not been adequately addressed. Faculty concerns about DL were observed during this study to fall into four major areas: age, compensation, impact on tenure, and protection of intellectual property. This chapter addresses these four major faculty concerns and successful solutions implemented by various institutions.

The following assumptions are relevant in addition to those described in the Introduction. First, web-based DL will continue to grow because it is more flexible and accessible than synchronous delivery. Second, as rational actors, faculty will only support instructional delivery programs that protect basic equities while creating additional tangible benefits. Third, institutions will continue to require faculty to research and publish as well as instruct as a major job function. Fourth, faculty and institutions will support any mutually beneficial scheme that protects each other's equities at reasonable cost. Fifth, this problem is a suitable issue for this technology benchmarking effort because technology can only support more than marginal improvements by co-evolving with organization and policy. Sixth, the role of the subject matter expert as personal consultant is as important as his/her role as instructor.

Against these assumptions, the following relevant facts were uncovered that further define the problem and bound the issue. First, web-based DL is not only growing but probably accelerating. In 1994 there were reportedly about 40 institutions of higher learning with programs of education for credit at a distance using synchronous and/or web-based delivery. By 1997, the number exceeded 700 and continues to grow at an apparently accelerating rate. Contributors at most academic and corporate institutions described a growing incipient demand for "any time /any where", web-based education and training among their clientele. That is important. Failure to meet demand in a competitive market place is fatal.

Second, preliminary study results suggest that, even with new efficiencies in course management, faculty invest about one-third more effort in web-based instruction than in traditional teaching methods. Third, the marketplace for instructional courseware is strong enough to offer quick rewards to persons willing to pirate intellectual property for profit. Fourth, innovations in support tools like Frequently Asked Questions (FAQ) databases were found to greatly reduce faculty burdens.

A discussion follows based on these assumptions and facts that bear on the problem. Most senior faculty members predate the personal computer and have had no incentive to learn to use it. This marginalizes their contribution to a DL initiative at the outset. At George Washington University, MIT, and several others, initiatives in DL included web-based self-instruction in courseware development, delivery, and management. Self-paced instruction for faculty members was backed up by tutored learning and on-line support. This was the least significant of the reasons for faculty resistance because it is self-correcting, albeit slowly, by retirement and other natural attrition.

The second reason for general faculty resistance is compensation. Early data uniformly suggests that DL programs require more hours of work than conventional systems. Student queries were the most mentioned reason for additional faculty time. The clock usually governs classroom Q&A sessions as well as faculty office hours. Email sessions are open-ended. They start and stop independent of schedule. The most innovative programs have incorporated FAQ databases and highly responsive commercial search engines to "read" student queries and generate answers. These support tools save faculty time. Teaching assistants are also being used to screen queries, answer the easy questions and sharpen the harder ones.

The third reason faculty resisted web-based DL was found to be the "publish or perish" syndrome, where tenure or satisfactory performance was tied to publication. Innovative institutions such as Indiana University give publications credit to faculty for developing DL courses and ancillary tools for delivery and management. Incorporating this form of electronic publishing into faculty manuals as an acceptable substitute for a refereed journal article was found to significantly boost faculty participation. A variation that was frequently seen was "partnering". Once developed, courseware was marketed to other colleges, including small independent or community colleges in return for royalties on a "per use" basis. Incoming royalties were viewed as a revenue stream for department chairs to use in awarding faculty bonuses, grants, and awards.

The fourth reason faculty resisted DL was for perceived inadequate protection of intellectual property on the Internet. The argument goes that for many faculty, their courseware and backup research are their life's work. If placed on the web for all to see, theft will eventually spawn usurpation at their economic expense. This is fundamental Maslow; a survival issue; the floor of a faculty member's hierarchy of needs. Most institutions are wrestling with this issue. A few, like MIT, have attempted to meet the faculty member's needs by permitting individual copyrights on materials authored at work, and the full weight of the institution to help in copyright defense.

Professional educational associations like UCEA are at work on model legislation and faculty policy to incentivize faculty to place their research in public view while protecting it and assuring faculty the royalties to which they are entitled. A "virtual forum" debating this issue, (http://www.theatlantic.com/issues/98sep), sponsored by *The Atlantic Monthly (Unbound)* began at the time this article was written.

Beyond the four primary reasons for faculty resistance to DL, there are others. Most can be characterized as following the leadership on campus. At George Washington University, for example, the leadership has clearly articulated a desire to move graduate level courses into distributed learning, while preserving the classroom for the undergraduate level. Campus leadership has actively set the bounds for innovative development. At MIT, development of distributed learning courseware is encouraged, but degree programs cannot be fully completed via DL. At the Western Governor's University, everything is done via the web. At both places, campus leadership has defined the present limits for development and the faculty knows how to respond.

At the Army War College, the correspondence course has been selected for development via DL. Is this a clear message? Some would argue that the correspondence program has never been the mainstream at Carlisle. Is the mainstream resident instruction program off-limits for DL? Faculty members need a clearer message.

Observers can point to a pattern at DoD of answering constant prodding from Congress by converting some Reserve Component instruction to DL. Is RC instruction the mainstream at DoD? What mainstream education or training at DoD is or has been converted to or supplemented by distributed learning? The efforts now underway to establish the Defense Acquisition University and to mainstream Global Command and Control System training may be the harbinger of a clearer message that the time has come. Given clear leadership guidance, the faculty will do its job.

In conclusion, it appears clear that faculty buy-in is fundamental to the successful application of new educational technology. Faculty incentives combined with an extension of the protective environment that has been the ancient hallmark of academe can provide the co-evolution of organization, policy and technology that are necessary to underwrite a successful program.

Chapter Seven: Future Trends

A primary component of Joint Vision 2010 (JV 2010), which seeks to establish a template for how America's Armed Forces will achieve new levels of readiness in the joint warfighting environment of 2010, is technology. Certainly the requirements of our present and near future warfighters will be ably assisted by technological innovations that are currently being explored, if not refined, for use and application. However, in looking into the 21st century, it can be presumed that technologies that go well beyond contemporary levels of technological creativity and development will evolve to meet the goals of JV 2010 and a JPME program that will provide an innovative learning environment for the officer cadre serving in the joint force.

As part of its mission, the EdTech Team interviewed leaders in academia, industry, and the government for their individual perspectives on future trends. The results were placed in individual site reports, included within this overall study, and extracts from the future trend data used to compile this report.

In surveying thoughts on future trends into the 21st century, a consensus of sentiment seemed to be, as stated at Pennsylvania State University, that 2010 is 100 years away. [25] Certainly individuals and research institutions, whose livelihoods are based on such research, are exploring the vast realms of possibilities.

But for many dealing with the current-day development of technologically-enhanced products for use in the learning environment, future trends are defined as three-to-five years in the future. A commonly shared opinion found in both academia and industry, and as succinctly suggested by Artifex, a commercial 3D visualization and information design firm under contract with Indiana University, is that developers are so involved in trying to meet the challenges posed by the seemingly non-stop influx of new products onto today's market, that they have little time to ponder far into the future.[26] Consequently, many of the findings were metered in the extent of vision. They suggest an emphasis is being placed on current or emerging technology and its refinement and use into the next few years and less on the dynamics of a 2010 environment.

Nevertheless, certain themes did surface in the interviews, one of the more common which focused on the concepts of "learning by doing" and the application of technology to learning through "storytelling scenarios," concepts currently being embraced and envisioned for future-looking technological enhancements. A leader in this area of research and development is Northwestern University's Institute for Learning Sciences (ILS).

In general terms, the ILS faculty and staff believe that individuals learn best by doing what it is they're supposed to learn. Furthermore, they believe that individuals remember information contained in stories told them more readily than in printed form.[27] Through the use of sophisticated engines or tools, story-based scenarios, and video, ILS crafts active learning environments that place the student in the midst of a scenario, requiring the student to ask questions, respond, and make decisions. This has proven to be a highly successful approach to cognitive-based learning.

As a Research and Development facility, ILS is highly focused on the future. In the area of future trends, it believes that value can be added to the application of virtual reality (VR) and gaming technology in instructional settings, even to the desktop, but it cautions that whatever technology moves to the forefront of a 2010 world should not be pursued unless it enhances the learning process, and it should not be used simply because it's the latest technology.

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[25] Pennsylvania State University site survey, 16 September 1998
[26] Indiana University site survey, 3 September 1998
[27] Northwestern University, Institute for Learning Sciences, site survey, 2 September 1998

Similarly, the Massachusetts Institute of Technology (MIT) Media Lab is leveraging and adapting work done by ILS in the development of the "Ask Engine" scenario-based Battalion Training Management System, created for the United States Army's Fort Leavenworth.[28] The Media Lab is expanding the general engine and concept to support environmental training and simulators for training. Using a military analogy, the research could lead to a virtual exploration of a historical or hypothetical battlefield situation merging animation, aerial photography, and digital terrain elevation data with sophisticated programming. The student could then explore the entire development of battlefield strategy from an on-the-ground perspective. The application of gaming techniques and engines could then permit the user to actively engage in the strategic decision making process, experience the consequences, and determine alternative courses of action.

In a related initiative at the MIT Media Lab, a further indication of successful storytelling in a technologically-enhanced learning environment offers a future enhanced development that merges objects and storytelling engines such as ConTour that incorporates multiple perspectives, paths, and multi-media applications into a highly interactive learning environment.[29] An example postulated was a matrix of linked objects that store all known information about Operation Desert Storm, to include such data as chronology, tactics, units, weapons, outcomes, lessons learned, expenditure rates, and intelligence products. The engine would then allow the user to explore the strategic operation from any perspective and, though extensive branching and sequels, track all aspects of the operation.

Industry has taken note of these specific concepts and envisions their future application within their individual learning programs. For example, Boeing Corporation envisions participatory games or simulations in their instructional strategy and hopes to increase the use of scenario-based learning to create more realistic environments in which to enhance learning by doing. It is not inconceivable to anticipate future development of high fidelity models that realistically simulate natural environments and individuals with which the user acts and reacts in the context of these concepts.

A high degree of future thinking and exploration into the application of sophisticated technology to enhance learning environments finds substantial work being done at Indiana University, Bloomington. This is borne out by the University's comprehensive "Information Technology Strategic Plan—Architecture for the 21st Century," which is designed to carry the University into the next millennium.[30] This document fully embraces the importance of both advanced technology and its exploration in support of the development and application of ever-increasingly realistic learning experiences.

Indiana University intends on continuing collaborative ventures into the realm of teleimmersion, haptic devices, and wearable computers, areas of research receiving substantial interest in today's research and development communities. Beyond this, Indiana University has made significant strides into the use of fully immersive 3-D VR environments. Included are its collaborative work with the University of Illinois and its Electronic Visualization Laboratory (EVL), the Argonne National Laboratory, and others in the areas of the Cave Automatic Virtual Environment (CAVE),[31] ImmersaDesk,[32] and other immersive technologies.

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[28] Massachusetts Institute of Technology Media Lab, site survey and interview with Dr. Brian Smith, 19 September 1998

[29] Ibid. Interview with Dr. Glorianna Davenport, 19 September 1998.

[30] Indiana University Information Technology Strategic Plan—Architecture for the 21st Century, http://www.indiana.edu/~ovpit/strategic.

[31] The CAVE was developed by ELV, University of Illinois, Chicago. It is an enclosed room in which users see, touch, hear, and manipulate data while interacting with 3-D holographic-like images on the walls and floors.

As research in these areas continues, Indiana University anticipates these technologies will form the basis of future trends as they apply to learning environments. Among those future applications, Indiana University envisions the application of VR to studies in perception and cognition, intelligence augmentation, and the modeling of interactive virtual environments for use in distance education.[33]

Pennsylvania State University has likewise risen to the top of innovative organizations involved in distributed learning and the use of cutting edge technology to enhance that learning. Among its suggested future trends are increased development of full immersion technology and its application into distributed learning environments. Trends include continued research in ImmersaDesk technology and its use in visualization of simulation data, virtual prototyping, and interactive data mining, increased exploration of CAVE technology, and heightened leveraging of technology relating to intelligent tutors and agents.[34]

In its 1992 Report of the Task Force on Distance Education, Pennsylvania State University recognized the benefits of multimedia capabilities, interactive programming, and digital-based systems as applied to distance education. It saw the constant evolution of delivery systems that will continue to impact the dynamic changes in future learning that extends the confines of space and time.[35] Despite the valuable contributions Pennsylvania State University has made and continues to pursue in the areas of technology and the learning environment, it was cautioned, when thinking about future trends and possibilities, that we are still in a state of technological infancy.

The University's subsequent establishment of Innovations in Distance Education, in 1995, cited guiding principles and practices for the design and development of effective distance education, while allowing that technology should always be seen as a supporting element of learning and not the driving force behind it. This sentiment was again expressed through the University's esteemed American Center for the Study of Distance Education, founded by Dr. Michael G. Moore. In an interview, he emphasized that technology is not the focus of learning. People involved in the development and design of learning programs and materials need to finely tool the content and process and make sure there's student support at the other end. As for future vision, the American Center can envision future learning environments involving immersion technology and CAVEs.[36]

At Carnegie Mellon University and its Center for Information Systems Engineering, current and near-term research provides the basis for future thinking and applications to learning environments in such areas as advanced electro-optic technology, specializing in optical-based instrumentation, holography, imaging technology, and computer-based modeling and optical design. These efforts find ready association with target identification for the military; computer-software engineering and artificial intelligence applications to human cognition principles

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[32] ImmersaDesk was developed by ELV, University of Illinois, Chicago. It is a drafting-table-sized device that serves as a smaller-scaled version of the CAVE that functions outside of a specialized room.
[33] Indiana University site survey, 3 September 1998.
[34] Pennsylvania State University site survey, 16 September 1998.
[35] Pennsylvania State University Report of the Task Force on Distance Education, http://www.outreach.psu.edu/de/de_tf.html.
[36] Pennsylvania State University, interview with Dr. Michael Moore, Director, American Center for the Study of Distance Education, 16 September 1998.

> in decision-making; and neural networks and expert systems for use in enhanced decision-making capabilities.[37]

Carnegie Mellon University also foresees continued exploration into such high profile areas as videostreaming technology, speech recognition, and synthetic interviews. Work is ongoing on performable characters, a means by which individuals interact with synthetically-designed characters that have such human traits as defensiveness and aggressiveness, with the coding technology making decisions as to who should speak and the tone with which they speak. Generation X recognizes these as the avatars they use to represent themselves in cyber-games. These technologies can be envisioned in highly realistic military training scenarios that require action and reaction to friendly and adversarial forces.

Certainly when envisioning future trends that extend to 2010, VR is a technology that offers considerable opportunities for exploration and development. The military services have been highly active in this field. In fact, their many initiatives have been responsible for ground-breaking developments within the overall field of research and development.

In 1997, a panel of scientists and managers reviewed the funded research and development initiatives within DoD and NASA in the area of VR. The panel's substantive report[38] evaluated primary VR developmental systems for each of the services as they relate to human services and information systems in such areas as collaboration; operational and training systems metrics; programmatic issues as applied to personnel, focus, and funding; recommendations; and future technical issues. It is in the area of future technical issues that general assumptions can be made concerning future trends within the DoD as they relate to VR.

Many of the themes presented in the study likewise surfaced in academia, among them advanced research into haptic devices. Haptic devices simulate pressure or force sensations found in such activity as operating a control stick or lever. Other advanced research includes 3-D audio and video that seeks to exploit interaction between human auditory perception capabilities and visual perception. Also relevant to learning is the VR-assisted simulation and perception of wide bandwidth capabilities through the use of narrow bandwidth and the integration of sound, visual, tactile, haptic, olfactory, and movement components of VR in crafting the illusion of full immersion in a real environment.

The DoD/NASA study further suggested future development or trends involving human performance modeling, computer generated forces that contain realistic individual and unit-level behaviors, and the creation of high fidelity synthetic terrain fields to permit realistic engagements on a field of battle.[39] Interest has been expressed by the National Research Council for more research and development into tracking technologies that will place a human into large-scaled, networked environments and the development of computer-generated characters that can adapt, learn, and display varied behaviors.[40]

Developmental efforts can be expected to continue in the area of integrating speech and gestures into a system that permits a synthetic character in a virtual environment to interact with a human as if it were a cohort or adversary. Included is the insertion of a human in a virtual environment to interact with a synthetic character, or avatar.[41] And, in more cognitively-centered applications, future trends will likely encompass developing models that optimize understanding how people learn and developing appropriate learning mechanisms.[42]

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[37] Carnegie Mellon University site survey, 21 September 1998

[38] Dr. Anna Johnson-Winegar and Mr. Philip Brandler, DDR&E Panel on Human Systems, Regarding Virtual Reality Programs Conducted by Army, Navy, Air Force, NASA & DARPA, 30 October 1997.

[39] Ibid. (p. 28)

[40] Ibid. (p. 34)

[41] Ibid. (p. 39)

[42] Ibid. (p. 23)

Substantial challenges continue to exist, despite the impressive work done in the area of virtual reality and virtual environments. As reflected in the study, these challenges, which, if met, serve as indicators for future trends. However, one of the most serious challenges facing VR development does not involve technology. It involves funding.

The VR report emphasizes the need for increased funding in the area of modeling and simulation. Philip Brandler, one of the co-authors of the study, indicated during an interview, being able to foresee the development of intelligent agents that can be linked together into process or action officer-level scenarios. Such scenarios would permit analysis of processes involved in battlefield control and assessment. Individuals could interact with adversarial agents or each other. He realistically indicated that while such innovative design work is within the realm of the possible, unless funding is requested and procured by outside agencies, such development would remain dormant.[43]

Not surprisingly, a study of future trends in a technologically-enhanced society finds natural affiliation with the entertainment industry. In fact, a generally found assumption in the area of high-technology applications to product development within DoD has been that the entertainment industry is leading the way. As a general assumption, this is not an incorrect perception. However, it has been found that much of the military's needs in areas associated with modeling and simulation actually exceed the economic reach of the entertainment industry.

Nonetheless, there has long been a growing interest in modeling and simulation between the DoD and the industry, which led the DoD Defense Modeling and Simulation Office to request the National Research Council's Computer Science and Telecommunications Board to bring together a committee to study the possible leveraging of individual capabilities in the area of technological specialization.[44]

The meeting, held in 1996, assembled over 50 representatives of DoD and the entertainment industry to discuss technical challenges shared between the two seemingly diverse groups, to identify obstacles, and to propose solutions encouraging collaboration. Among the myriad issues discussed were the identification of common technical needs and areas offering the most likelihood of collaboration, the identification of human resources, and the establishment of mechanisms for information sharing and technology transfer.

In general, it was felt that there is much to be gained through collaboration, but it was also fully acknowledged that implementation of the mechanisms to allow collaboration between these two disparate cultures will take time. The report suggested that areas holding the greatest potential for shared research and development were networked simulations, standards of interoperability, computer-generated characters, tools for crafting simulated environments, and immersive simulated environments.

The findings explored these issues extensively and pointed out several barriers that will in all likelihood prevent full partnering to take place. In considering future trends and the leveraging of capabilities between the entertainment industry and DoD, it is important to temper optimistic enthusiasm about exciting possibilities by looking at a few of these barriers. One is culture.

The DoD and the entertainment industry are two different cultures. Despite some sharing of advanced technology, they have operated independently and traditionally have not seen a movement of personnel between the two activities. In part this is due to the lack of substantial profit on the part of the entertainment industry in working on defense contracts and on the bureaucracy associated with government-affiliated contracts, especially in the area of acquisition regulations and purchase of final product.[45]

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[43] Naval Air Warfare Center, Training Systems Division, site survey, 9 September 1998.
[44] Modeling and Simulation, Linking Entertainment and Defense, http://www.nap.edu/readingroom/books/modeling.
[45] Ibid. (pp. 84-88)

Time spans of project development also poses problems for collaboration. Many military projects are of long duration, frequently covering 10 or more years. They usually involve upgrades and upkeep. In contrast, entertainment projects tend to be of much shorter duration and typically have built-in obsolescence, and, again, the profitability factor is much higher.[46]

As with academia and its concerns with issues of intellectual property in light of the Internet and other distributed learning technologies, so do is there concern over intellectual property in collaborative ventures between the entertainment industry and the military. Not surprisingly, the entertainment industry highly guards its work. Many of the more technology-based architectural aspects of entertainment products are developed with reuse in mind. Technology used today by the entertainment industry will frequently be enhanced and improved for use in tomorrow's applications. And, of course, there is the natural issue of competition between similar industries. There tends to be a significant concern on the part of the entertainment industry that intellectual property will not be as protected or that the industry will not have full control over its rights when working with defense contracts.[47]

Although there are many issues that serve to hinder full exchanges between the entertainment industry and the military, there are many possible ways in which degrees of collaboration can occur, which are cited in the study.[48] However, the bottom line suggests a continued and concerted effort must be made between the two communities to make possible the exciting and mutually rewarding collaborations that are possible. Otherwise, the barriers will remain and potential will not be achieved.

The EdTech Team explored with Universal Studios in Orlando, Florida, sophisticated technologies that might be advantageous to a JPME system of the 21st century.[49] It was generally felt that, within the personnel structure of the JPME, the most favorable application of simulation and modeling technology would be in the creation of operational, strategy-driven scenarios. These would involve such devices as 3-D film that surrounds the individual, motion simulation, moving points of reference, high fidelity computer-generated imagery, and effects that simulate and stimulate the basic senses—sound, sight, smell, touch.

> To be effective, such scenarios would have to incorporate into their development sophisticated levels of branching that would allow the individual to choose his or her own course of action and experience the result of the decision. Universal Studio indicated that the creation of such a scenario would be extraordinarily costly due to the need for extremely high fidelity of imagery. It is this very reason that Universal Studio supports continued exploration of a more cost-effective approach to this technology and why it is not currently engaged in its application. Concerning holographic imagery, Universal Studio likewise believes this technology to be in its infancy stage but holds great promise for the future.
>
> Despite the excitement that is easily generated when discussing the application of high-end technology to the learning environment, it is imperative to keep in mind the reason for using the tools. All the virtual reality and modeling and simulation developments possible will not be successful if they're not developed for the right reason—learning. In nearly all surveys done, a bottom line consistently was that technology of today and that of forming the basis of future

[46] Ibid.
[47] Ibid.
[48] Ibid. (pp. 88-92)
[49] Universal Studios site survey, 11 September 1998.

trends, should not be the deciding factor in development. The focus must always be on learning.

In summary, exploring the world of future trends and applications to the learning environment, whether for a PME program or for JPME 2010, possibilities are limited only by imagination. New ways to learn are being developed. Generation X learns more interactively than did previous generations. As has been frequently shown throughout the surveys and as a primary assumption of the EdTech Team, technology is not the issue or problem. The technology needed to promote exciting new learning opportunities will be available. The entertainment industry is already building them. Unquestionably, modeling and simulation of varying degrees of sophistication will find future warfighters exploring and actively interacting in immersive virtual environments. They may well play out battles to such a high degree of fidelity that, as the Joint Simulation System Joint Program Office suggests, the next battle may be won before the war starts through the use of advanced technology.[50]

This positive posture, however, must be tempered with reality. Much of the development that will evolve into future applications takes place within academia and industry, using internal personnel resources. These talented individuals are challenged to stay abreast of today's fast-changing technological innovations and to master them. For these people, the future vision extends out only three to five years. But it is constantly reviewed and pushed further out.

The corporate world and research and development concerns, including those founded throughout academia, offer more advanced and futuristic potential. However, funding and research grants will continue to drive much of the work that is done. Even within the collaborative world of the entertainment industry and the government, there are barriers that pose challenges, not the least of which is also funding.

In order for future technology to achieve the degree of sophistication necessary to validate JV 2010, its push for information superiority, and the development of technological systems to enable a Joint Professional Military Education system of 2010 to produce the cohesive, well-trained, and joint-focused force necessary to carry out the mandates of JV 2010, increased collaboration must be pursued across all boundaries of technological expertise.

The government must reach out to the best and the brightest in both academia and industry and must seek, as well, to bring into its ranks the best and brightest who have the vision, knowledge, and desire to explore the unknown. This will require the allocation of funding. To tap into the considerable skills available through not only the entertainment industry but also through industry and research and development organizations, a re-engineering of governmental business practices to soften the resistance many have toward entering into collaborative endeavors with the government should be considered.

Only by a commitment on the part of all concerned and all who should be involved in associated future technological developments, both for training and learning, can we be assured the tools, techniques, and talents needed to lead the way into the 21st century will be in place, capable of functioning in an environment of Full Spectrum Dominance.

[50] Joint Simulation System briefing, Naval Air Warfare Center, Training Systems Division, 9 September 1998.

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Glossary

Advanced Distributed Learning (ADL)
A DoD initiative to promote widespread collaboration, exploit Internet technologies, develop next generation learning technologies and create reusable content, and lower costs, with object-based tools.

Appended Systems
Embedded Training systems appended, or strapped on to operational equipment.

ASK Systems
ASK systems were developed at Northwestern University's Institute for the Learning Technologies (ILS). Case-based systems tell students exactly what they need to know, when they need to know it. When students learn by doing, they experience knowledge failures—times when they realize they need new information to progress. Case-based teaching provides that knowledge. The ASK system employs an indexed database of video clips of subject matter experts. These clips are associated with questions learners are most likely to ask and not only respond to the question, but provide a new set of related questions the learner can draw upon.

Asynchronous
Transmission which does not occur simultaneously with the audio and video associated with the broadcast. Computer Based Training (CBT) and traditional correspondence courses would be considered to operate in the asynchronous mode.

Audio Bridge
Specialized equipment that permits several telephone lines to be joined together in a conference call.

Audioconferencing
Instruction delivered by two-way voice communication.

Audioconferencing Unit
A stand-alone microphone that provides a means for students to provide verbal feedback to the instructor.

Audiographics
Two-way audio and two-way computer data exchange.

Bandwidth
The frequency width needed to transmit a communications signal without excessive distortion. The more information contained in a signal, the more bandwidth it requires for distortion-free transmission.

C-Band

A type of satellite transmission with less path loss than other satellite standards such as Ku-Band. C-Band, however, requires a relatively large antenna. C-Band frequencies are shared with terrestrial microwave transmissions, which cause interference with weaker satellite signals.

CODEC

Coding-decoding equipment used to convert and compress analog video signals into a digital format for transmission, then convert them back to analog signal upon reaching their destination.

Collective Training

Training conducted with a team, crew, or group.

Compressed Digital Video (CDV)

A type of transmission of audio, data and video by satellite that uses 3.3 or 6.6 Mbps compression algorithm.

Computer Assisted Instruction (CAI)

A term referring to courses delivered using a personal computer and includes floppy disks, CD-ROMs, and Internet-delivered courseware.

Computer Based Instruction (CBI)

The same as computer assisted instruction.

Computer Based Training (CBT)

The same as computer assisted instruction.

Compressed Digital Video (CDV)

A digital transmission process used by commercial vendors and others to deliver TV-quality video in a way that reduces the amount of data required to be transmitted. While compressed video requires less bandwidth, signal quality is reduced. As a result, picture quality is not generally as good as full-motion, with quick motions often appearing somewhat blurred.

Compression Rate

The figure used to estimate the number of hours of instruction required to conduct an existing resident course if converted to the given technology.

Compression Software

Compresses digital video for storage and transfer using CODECs (COder/DECoder) algorithms.

Computer-Managed Instruction (CMI)
Interactive Courseware (ICW) component that enables student record-keeping.

Computer-Mediated Conferencing (CMC)
Another way of conferencing using the personal computer and telephone lines as the communication vehicles. It provides instructor-student and student-student interaction in both an asynchronous and synchronous mode.

Constructed Model or Simulation
Models and simulations that involve simulated people operating real systems.

Course Director/Manager
The person responsible for the development of an instructional sequence. This person often serves as the primary presenter.

Digital Video Disc (DVD)
An electronic storage and read-only medium with 5 to 50 gigabits of storage space.

Distance Learning (DL)
Distance learning is defined as "Structured learning that takes place without the physical presence of the instructor." This definition includes correspondence courses, satellite broadcasts, videotape and computer-based instruction or any combination thereof.

Distance Learning Classroom; same as Electronic Classroom (EC)
Any location where learners can receive instruction electronically from a remote or local instructor. An EC can include Student Stations, Instructor Stations, Presentation Monitors, Audiovisual Equipment, and Telecommunications Equipment. Electronic communication with the EC can include Television, Satellite, Internet, Commercial Education and Training Networks, and Military Education and Training Networks.

Distributed Learning
Learning in any environment where the instructor and the students are in different places when instruction takes place. Can be synchronous or asynchronous, using any or a combination of suitable media. Also called *distance learning* but more inclusive than audio and/or video teleconferencing, correspondence courses and other traditional means of remote learning.

Downlink
A location where equipment receives a satellite or ground based signal(s) for display on video, audio, or data receiving equipment. Normally, a downlink includes a room equipped for display of satellite signal(s) through a TV monitor and permits occupancy by 15 to 50 people.

Electronic Classroom (EC); same as Distance Learning Classroom
Any location where learners can receive instruction electronically from a remote or local instructor. An EC can include Student Stations, Instructor Stations, Presentation Monitors, Audiovisual Equipment, and Telecommunications Equipment. Electronic communication with the EC can include Television, Satellite, Internet, Commercial Education and Training Networks, and Military Education and Training Networks.

Electronic Management Tools
Computer programs that can aid in the instructional process.

Electronic Performance Support System (EPSS)
Just-in time ICW designed to enable learners to gain access to large amounts of information, provide tutorial ICW and ICAI, and provide advice and coaching through a user-friendly interface. An EPSS is typically embedded into an application to allow it to "pop up" to meet the immediate learning demands of the user.

Electronic Testing
A general term used to encompass all methods for applying computers in the assessment and reporting of human knowledge, skills, and attitudes. It is also known as Computer Adaptive Testing (CAT).

Embedded Training
A training capability which is designed into or added onto operational equipment.

Exportable Training
Training that is sent out or 'exported' to a field location; also referred to as Type 6 training. See Distance Learning.

Facilitator
(See instructional facilitator)

Fax Conferencing
Electronic data transfers between individuals over telephone networks using facsimile equipment or over the Internet using fax modems.

Formative Evaluation
Provides information about the effectiveness of products and processes as they are being developed. Performed periodically from initial ISD planning throughout the development phase; can include small-group tryouts of instructional components; used to validate design of individual components of the instructional system for integration. Objective is to identify deficiencies early, when revision is least expensive.

Hypertext Mark-up Language (HTML)
A language of Internet Web Pages (WWW), allowing authors to create text and graphics, and link to other Web pages.

Instructional Management System

A non-proprietary, Internet-based Instructional Management System that provides the means to customize and manage the instructional process and to integrate content from multiple publishers in distributed or virtual learning environments.

Instructional Systems Development
An adaptation of the systems engineering process to the process of curriculum development.

Instructional Facilitator
A content-knowledgeable person, not an instructor, at a downlink site who assists the content provider (normally at the uplink site) to conduct instruction using the satellite system.

Intelligent Computer Assisted Instruction (ICAI)
Interactive Courseware (ICW) component that includes an intelligent tutor that diagnoses student performance and individualizes instruction.

Internet-Based Instruction (IBI)
Instruction that makes use of Internet technologies and provides a platform for the integration and distribution of multimedia instructional components.

Internet-Based Training (IBT)
A term referring to courses delivered via the Internet.

Interactive Courseware (ICW)
Any type of computer-controlled education or training that relies on student inputs to determine pace, sequence and content of training delivery using more than one type of medium to convey the cost of instruction.

Integrated Electronic Technical Manual (IETM)
A type of Interactive Courseware (ICW) job aid that incorporates graphics, photographs, video, simulations, text, and access to database information.

Interactive Multimedia Instruction (IMI)
IMI is a group of computer-based training and training support products. IMI includes source materials that are commonly used in IMI products, electronic products used in the delivery of or supporting the delivery of instruction, and software management tools used to support instructional programs.

Integrated Operational Environment (IOE)
Merges real-world and synthetic operations to support all aspects of training and education, weapons systems deployment, strategic and tactical strategies and analysis, Joint theater-level operations, mission planning, mission rehearsal, etc.

Interactive Television (ITV)
An interactive means of instructing learners at a distance through the use of one-way video and two-way audio over a satellite communication link.

Interactive Video Teletraining (IVT)
Describes all satellite-based instruction. Composed of Video Teleconferencing (VTC) and Interactive Television (ITV).

Ku-Band
A type of satellite transmission of a higher frequency that C-Band transmission, requiring smaller antennas.

Live Simulation
A simulation involving real people operating real systems.

Mediated Interactive Lecture (MIL)
Remote or local instructor presentations in an Electronic Classroom using a lecture format.

Modeling and Simulation (M&S)
The use of models, including emulations, prototypes, simulations, and stimulations, either statistically or over time to validate a physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

Operational Evaluation
Includes periodic internal and external evaluation of the instructional program to ensure graduates meet established education and training requirements. Performed periodically from completion of the operational tryout throughout the life of the instructional system. Objective is continuous improvement and maintenance of instructional effectiveness.

Originating Facility
The site location from which transmissions originate.

Portable Electronic Display Device
A small electronic device that has been designed and engineered to facilitate the presentation of an IETM to a technician during maintenance procedures.

Professional Continuing Education (PCE)
Provides short course instruction in a broad range of essential educational programs to meet specific skills and functional competencies required in designated career fields. PCE courses provide learners with the opportunity to think critically, plan strategically, and give them the ability to apply those skills and knowledge to undefined future programs and challenges.

Professional Military Education (PME)
Education in the profession of arms and the employment of forces. It provides and develops the skills, knowledge, understanding and appreciation of leaders in the nation's armed forces.

Simulation
A method of implementing a model over time.

Site Coordinator/Monitor
An individual at a downlink site who is responsible for having the site ready for use, who assists learners and instructional facilitators or Job Site Training POCs in using the equipment in the classroom, and who often has other minor administrative support responsibilities. Often referred to as site monitor.

Student Response Units (SRU)
Provide voice, text, and data links from each student to the remote instructor.

Subject Matter Expert (SME)
(a) An individual who has thorough knowledge of a job, duties/tasks, or a particular topic, which qualifies him/her to assist in the training development process (for example, to consult, review, analyze, advise, or critique).
(b) A person who has high-level knowledge and skill in the performance of a job.

Summative Evaluation
Provides information to determine the "summed effect" of instruction under operational conditions. Used to assess full system integration and effectiveness of the individual components; based on an operational tryout of the program (normally 2 or 3 classes) using real student throughput and full instructional system operation. Objective is to ensure that the instructional system is fully integrated and achieves desired outcomes.

Synthetic Environments (SE)
Intermitted simulations that represent real-world activities at a high level of realism.

Technology Insertion
Use of appropriate instructional technology in resident instructional programs.

Teleconferencing (Video Teleconferencing: VTC)
Two-way video and two-way audio exchange.

Test Administrator
Person at a downlink who has responsibility for the acceptance, secure storage, distribution, control and return of assessment items.

Uplink

The location where equipment permits the transmission of video, audio, and data signal to a satellite. Uplinks can have multiple channels for transmission purposes. An uplink normally has the capability to function as a downlink.

Video Teletraining (VTT)

Training using audio and video technology delivered to learners at their location via satellite; this is typically a one-way video system with two-way audio.

Video Teleconferencing (VTC)

Instruction using audio and video technology delivered to learners at their location via terrestrial systems; this is typically a two-way video system with two-way audio.

Virtual Classroom

An Electronic Classroom where learners and instructors are not physically collocated.

Virtual Simulation

Models and simulations that involve real people operating simulated systems.

Virtual Stimulation

Models and simulations that involve simulated people operating real systems.

Virtual Reality Mark-up Language (VRML)

A language of Internet Web Pages (WWW), allowing authors to create animated graphics and simulations.

Web Based Instruction (WBI)

Term referring to courses delivered via the World Wide Web (WWW), through a Web Browser and using TCP/IP network protocols.

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